APPENDIX 'A' GEOTECHNICAL REPORT



WSP Canada Group Ltd.

2022 Local Streets Package 22-R-05

Prepared for:

Lissa Van Dorp WSP Canada Group Ltd. 111-93 Lombard Avenue Winnipeg, MB R3B 3BI

Project Number: 1000-043-19

Date: February 26, 2022



Quality Engineering | Valued Relationships

February 26, 2022

Our File No. 1000-043-19

Lissa Van Dorp WSP Canada Group Ltd. 111-93 Lombard Avenue Winnipeg, MB R3B 3B1

RE:

2022 Local Streets Package 22-R-05

TREK Geotechnical Inc. is pleased to submit our Final Report for the geotechnical investigation for 2022 Local Streets Package (22-R-05) project.

Please contact the undersigned should you have any questions.

Sincerely,

TREK Geotechnical Inc.

Per:

Nelson John Ferreira, Ph.D., P.Eng. Senior Geotechnical Engineer

Encl.



Revision History

Revision No.	Author	Issue Date	Description
0	AD	February 26, 2022	Final Report

Authorization Signatures

Prepared By:

Asad Dustmama & C.E.T.

Geotechnical Engineering Technologist

Reviewed By:

Angela Fidler-Kliewer, C. Tech Manager of Laboratory and Field

Services



Reviewed By:

Nelson John Ferreira, Ph.D., P.Eng. Senior Geotechnical Engineer





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1.0 Introduction

This report summarizes the results of the road investigation completed for the Local Streets Package 22-R-05 project. The project included drilling test holes along Canora Street, Downing Street, Palmerstone Avenue, Sargent Ave/Spruce St. Alley, and collecting pavement cores along Forest Park Drive, Grundy Avenue, Hume St./Kairistine Lane Alley and Telfer Street. The test hole information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure. The investigation was carried out following the City of Winnipeg RFP No. 476-2021 (Appendix B – Site Investigation requirement for public works street projects).

2.0 Road Investigation

The investigation included coring of pavement at 36 locations on 8 different local streets with drilling of test holes at 16 of the cored locations along four streets. WSP selected the investigation locations as shown on Figures 01 to 08 (attached) and the table below summarizes the investigation program per street.

Table 1: Road Investigation Program

Street	# of Locations	Investigation
Canora Street (Between Preston Ave and Westminster Ave)	3	Pavement Cores and Test Holes
Downing Street (Between Ellice Ave and Armoury Ave)	3	Pavement Cores and Test Holes
Palmerston Avenue (Between Ethelbert St. and Lenore St.)	6	Pavement Cores and Test Holes
Sargent Ave/Spruce St. Alley (Between Clifton St. and Ellice Ave)	4	Pavement Cores and Test Holes
Forest Park Drive (Between Sinclair St. and Airlies St.)	5	Pavement Cores
Grundy Avenue (Between Ingersoll St. and Garfield St. N.)	3	Pavement Cores
Hume St./Kairistine Lane Alley (Between Raber Rd. and Dexter St.)	6	Pavement Cores
Telfer Street N. (Between St Matthews Ave and Ellice Ave	6	Pavement Cores

The road investigation was conducted between January 26th and February 8th, 2022. The pavement structure (asphalt/concrete) was cored by Naimu Mujyambere and Asad Dustmamatov of TREK Geotechnical Inc. (TREK) using a portable coring press equipped with a hollow 100 mm or 150 mm diameter diamond core drill bits. The test holes were drilled by Asad Dustmamatov to a depth of 2.0 m below road surface by Maple Leaf Drilling Ltd. using a truck mounted drill rig equipped with 125 mm diameter solid stem augers. The sub-surface conditions were observed during drilling and visually classified by Asad Dustmamatov of TREK. Other pertinent information such as groundwater and



drilling conditions were also recorded during the drilling investigation. Disturbed (auger cuttings) samples and bulk samples retrieved during the sub-surface investigation were transported to TREK's material testing laboratory for further testing. Pavement core samples were also retrieved and logged at TREK's material testing laboratory

Core and test hole logs noted on the summary tables and test hole locations are based on UTM coordinates obtained using a hand-held GPS, and their location relative to the nearest address or intersection, measured distance from the edge of pavement, or other permanent features.

The laboratory testing program consisted of moisture content determination on all samples, as well as Atterberg limits, and grain size analysis (mechanical sieve and hydrometer methods) on select samples between 0.6 and 0.9 m below pavement as well as Standard Proctor and CBR testing. Information gathered for each street package is included in separate appendices (Appendices A to H). The information provided in the Appendices includes test hole logs, laboratory testing summary tables and results, photos of the concrete cores, and summary of pavement compressive strength.

Seven CBR's were completed on bulk samples of the soil units present below the pavement. Tests were performed on clay, silt, and a blend of clay and silt and clay material encountered within the prescribed sample depth for CBR testing and the results are shown in the table below.

Table 2: CBR Testing Summary

Sample Description	Street	Depth (m)	SPMDD (kg/m³)	Opt. Moistu re (%)	Percent Proctor (%)	Moisture Content (%)	CBR Value at 2.54 mm	CBR Value at 5.08 mm
Clay	Canora Ave (TH22-02, 03)	0.3-1.5	1611	21.7	94.8	22.7	5.5%	4.4%
Silt	Downing Street (TH22-05, 06)	0.3-1.5	1756	18.2	94.7	20.1	3.5%	2.9%
Clay	Downing Street (TH22-04, 05, 06)	0.3-1.5	1566	22.0	94.4	23.5	2.3%	1.9%
Clay	Palmerston Ave (TH22-07, 08, 09)	0.3-1.5	1565	21.5	94.5	23.3	4.6%	3.7%
Clay	Palmerston Ave (TH22-10, 11, 12)		1664	20.2	94.7	21.5	6.0%	5.2%
Clay, Silt and Clay	Sargent St/Spruce St Alley (TH22-13, 15)	0.3-1.5	1652	19.3	95.0	21.6	6.2%	4.9%
Silt	Sargent St/Spruce St Alley (TH22-14, 16)	0.3-1.5	1775	17.0	95.8	19.0	5.9%	4.8%

^{*} Testing completed on combining grab samples from the top 1.5 m of each test hole.



The test hole logs include a description of the soil units encountered during drilling and other pertinent information such as groundwater conditions and a summary of the laboratory testing results. The soils were classified in general accordance with the Unified Soil Classification System (USCS) and the AASHTO soil classification system (American Association of state highway and transportation officials). The AASHTO system classifies soils based on laboratory testing results from Atterberg Limits and grain size testing methods (hydrometer and mechanical sieve method). Where laboratory testing was not conducted, the AASHTO classification of the soils were interpreted based on a visual assessment as indicated with a (I) on the test hole logs and attached tables. For cohesive soils, the AASHTO system uses a combination of testing results to determine the Group Index of the soils and thus, were only determined where sufficient laboratory test data was available.

Eight concrete cores were selected for concrete compressive strength breaks and the length to diameter ratio ranged between 1.05 to 1.82 for the cores collected. The core compressive strength tests were tested in accordance with CSA A23.2-14C – wet dried condition. The measured compressive strengths were also corrected based on an adapted ACI 214.4R-03 Standard to estimate the in-place concrete strengths. The table below summarizes the compressive strength results while the compressive strength testing details and the correction factor methodology are included in Appendix E, F and H.

Table 3: Concrete Core Compressive Strength Results

Core ID (Location)	Uncorrected Compressive Strength (MPa)	Corrected Compressive Strength (MPa)
PC-01 (Forest Park Drive)	57.59	61.29
PC-03 (Forest Park Drive)	63.47	69.07
PC-05 (Forest Park Drive)	59.85	66.00
PC-12 (Telfer Street North)	64.55	73.99
PC-14 (Telfer Street North)	60.70	70.17
PC-15 (Telfer Street North)	64.65	74.80
PC-18 (Grundy Avenue)	45.92	52.49
PC-19 (Grundy Avenue)	58.95	67.60

3.0 Closure

The information provided in this report is in accordance with current engineering principles and practices (Standard of Practice). The findings of this report were based on information provided (field investigation, laboratory testing, geometries). Soil conditions are natural deposits that can be highly



variable across a site. If sub-surface conditions are different than the conditions previously encountered on-site or those presented here, we should be notified to adjust our findings if necessary.

All information provided in this report is subject to our standard terms and conditions for engineering services, a copy of which is provided to each of our clients with the original scope of work, or a mutually executed standard engineering services agreement. If these conditions are not attached, and you are not already in possession of such terms and conditions, contact our office and you will be promptly provided with a copy.

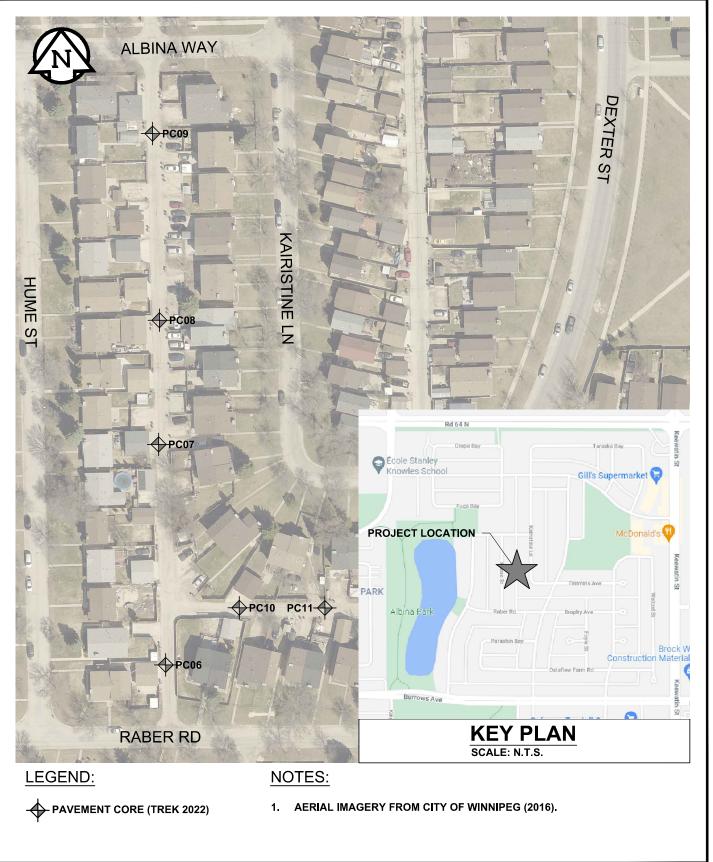
This report has been prepared by TREK Geotechnical Inc. (the Consultant) for the exclusive use of WSP Canada Group Ltd. (the Client) and their agents for the work product presented in the report. Any findings or recommendations provided in this report are not to be used or relied upon by any third parties, except as agreed to in writing by the Client and Consultant prior to use.



Figures



Z./Projects/1000 Soils LabtLab Projects/1000 Lab Projects/1000 Lab Projects/1000 0-043 WSP/1000-043 WSP/1000-043-19 2022 Local Streets Package (22-R-05)3 Survey and Dwg/3,4 CAD/3,4.3 Working Folder, 2022-02-22 9:05:31 AM



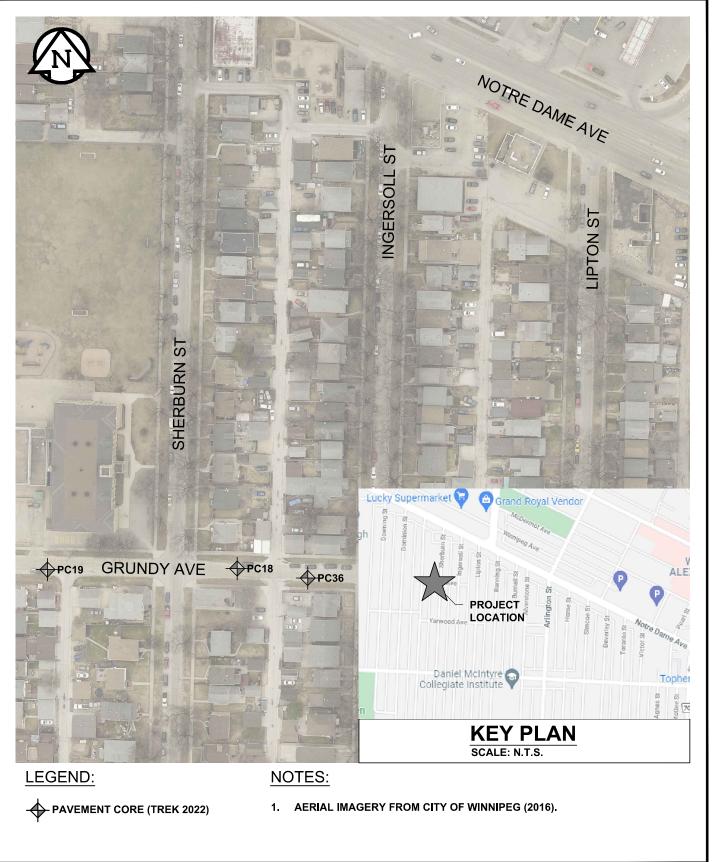


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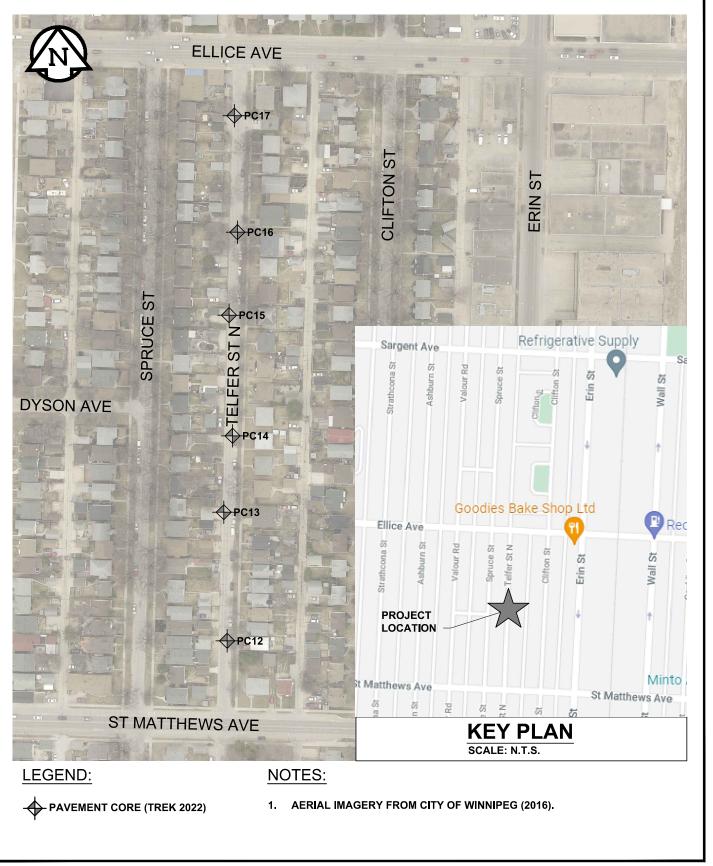


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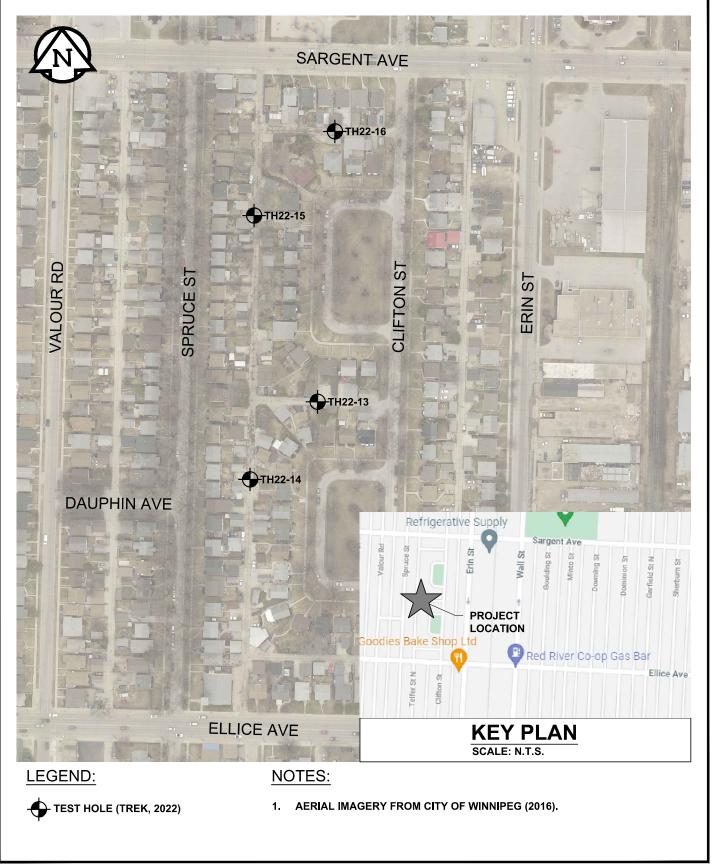


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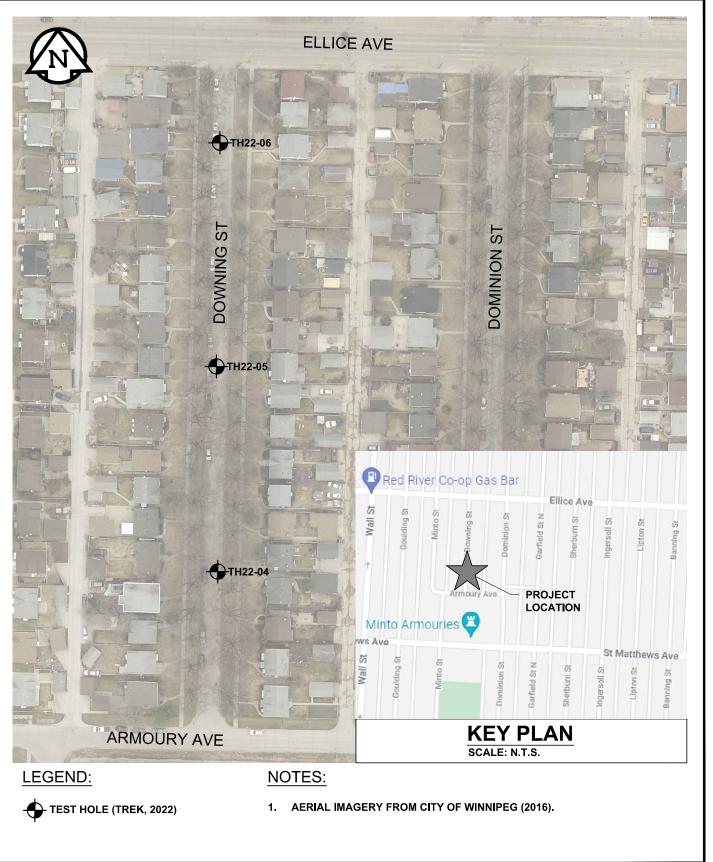


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Appendix A

Test Hole Logs, Summary Table & Lab Testing Results and Pavement Core Photos – Canora Street



EXPLANATION OF FIELD AND LABORATORY TESTING

GENERAL NOTES

- 1. Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- 2. Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- 3. When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Ма	Major Divisions USCS Classi- fication		Symbols	Typical Names		Laboratory Class	sification (Criteria		Si				
	action	gravel no fines)	GW	3.6	Well-graded gravels, gravel-sand mixtures, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ greater that	an 4; C _c = 1	$(D_{30})^2$ between 1 and 3		ASTM Sieve sizes	#10 to #4	#40 to #10 #200 to #40	< #200
200 sieve size)	Gravels than half of coarse fraction s larger than 4.75 mm)	Clean gravel (Little or no fines)	GP		Poorly-graded gravels, gravel-sand mixtures, little or no fines	urve, 200 sieve 1bols*	Not meeting all grada	ition require	ments for GW	a	STM Si	#10	#40 t #200	* *
	Gray than half o larger tha	Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	rain size c rthan No. g dual sym	Atterberg limits below line or P.I. less than 4		Above "A" line with P.I. between 4 and 7 are border-	Particle Size	٩			+
ained soils larger thar	(More t	Gravel w (Appre amount	GC		Clayey gravels, gravel-sand-silt mixtures	vel from g on smaller llows: W, SP SM, SC s requiring	Atterberg limits above line or P.I. greater tha	e "A" ın 7	line cases requiring use of dual symbols	Part		5	00 25	
Coarse-Grained soils material is larger than No.	fraction nm)	sands no fines)	SW	****	Well-graded sands, gravelly sands, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP More than 12 percent GM, GC, SM, SC 6 to 12 percent Borderline case4s requiring dual symbols*	$C_U = \frac{D_{60}}{D_{10}}$ greater that	an 6; C _c = 1	$(D_{30})^2$ between 1 and 3		шш	2.00 to 4.75	0.425 to 2.00 0.075 to 0.425	< 0.075
half the	nds of coarse frac an 4.75 mm)	Clean sands (Little or no fines)	SP		Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW		-			o o			
(More than	than h	Sands with fines (Appreciable amount of fines)	SM	333	Silty sands, sand-silt mixtures	Atterberg limits below "A" Above "A" line with P.I.		er-al	5			Clay		
	(More is	Sands with (Apprecia amount of fi	SC		Clayey sands, sand-clay mixtures	Determin dependin coarse-g Less t More	Atterberg limits above line or P.I. greater tha		line cases requiring use of dual symbols	Material		Sand Coarse	Medium Fine	Silt or Clay
size)	s/s	. (ML		Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity	80 Plasticity	Plasticit		t runte		Sizes	Ë	i.	Ë
Fine-Grained soils material is smaller than No. 200 sieve	Silts and Clays	ss than 50	CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	70 – smaller th	an 0.425 mm		"I THE	e)	ASTM Sieve Sizes	> 12 in. 3 in. to 12 in.	3/4 in. to 3 in.	#4 to 3/4 in.
soils er than No.	Sis	~ <u>o</u>	OL		Organic silts and organic silty clays of low plasticity	NDEX (%)	1	/ cth		Particle Size	AST	+		-
-Grained a	s,	50)	МН		Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts	PLASTICITY INDEX				Par	mm	> 300 75 to 300	77	4.75 to 19
Fine- the material	Silts and Clays	ater than 6	СН		Inorganic clays of high plasticity, fat clays	20 -	6		MH OR OH		Ε,	> (75 tc	6	4.75
(More than half the			ОН		Organic clays of medium to high plasticity, organic silts	7 4 0 10	ML or OL 16 20 30 40 50 LIQUIE	60 70 D LIMIT (%)	0 80 90 100 110	<u>.</u>	5	ers es		
(More	Highly	Soils	Pt	6 70 70 50 50 7	Peat and other highly organic soils	Von Post Class	sification Limit		olour or odour, Infibrous texture	Material		Boulders Cobbles	Gravel	Fine

^{*} Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.

Other Symbol Types

Asphalt	Bedrock (undifferentiated)	Cobbles
Concrete	Limestone Bedrock	Boulders and Cobbles
Fill	Cemented Shale	Silt Till
	Non-Cemented Shale	Clay Till



EXPLANATION OF FIELD AND LABORATORY TESTING

LEGEND OF ABBREVIATIONS AND SYMBOLS

PL - Plastic Limit (%)
PI - Plasticity Index (%)

▼ Water Level at End of Drilling

MC - Moisture Content (%)

Water Level After Drilling as Indicated on Test Hole Logs

SPT - Standard Penetration Test Indicated on Test Hole Logs
RQD - Rock Quality Designation

Su - Undrained Shear Strength VW - Vibrating Wire Piezometer

Qu - Unconfined Compression

SI - Slope Inclinometer

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE		
and and CLAY		35 to 50 percent		
"y" or "ey"	clayey, silty	20 to 35 percent		
some	some silt	10 to 20 percent		
trace	trace gravel	1 to 10 percent		

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Verv dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

Descriptive Terms	<u>SPT (N) (Blows/300 mm)</u>
Very soft	< 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very stiff	15 to 30
Hard	> 30

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Undrained Shear <u>Strength (kPa)</u>
< 12
12 to 25
25 to 50
50 to 100
100 to 200
> 200

Test Hole TH22-01

1 of 1



Sub-Surface Log

Client:	WSP Canada Inc		Project Number:	1000-043-19)				
Project Nam	e: Local Street Package 22-F	₹-05	Location:	UTM N-5527163, E-631741 (Canora Street)					
Contractor:	Maple Leaf Drilling Ltd.		Ground Elevation:	Top of Paver	ment				
Method:	125mm Solid Stem Auger, B40 N	Nobile Truck Mount	Date Drilled:	February 8, 2	2022				
Sample	e Type: Grab	(G) Shelby Tube (T)	Split Spoon (S	S) / SPT	Split Barrel (SB) / LP	T Core (C)			
	e Size Legend: Fines		Sand	Grave		Boulders			
			12.23		☐ Bulk Unit Wt	Undrained Shear			
Depth (m) Symbol				Sample Type Sample Number	6 17 18 19 20 21	Strength (kPa) Test Type			
Depth (m) ii Syml		MATERIAL DESCRIPTION			Particle Size (%)	△ Torvane △ ♣ Pocket Pen. ♣			
Soil				amp mple	PL MC LL	☑ Qu ☑ ○ Field Vane ○			
					20 40 60 80 100 0				
	ASPHALT - 100 mm thick			PC22-20					
	CONCRETE - 80 mm thick			PC22-20					
	SAND (FILL) - gravelly (<20 n - reddish brown	nm diam.), some silt, trace clay							
	 frozen to 1.5 m depth, o 	dry to moist, compact to dense wher	n thawed						
	poorly gradedrounded to sub-angular	,		G01	•				
-0.5-	- AASHTO: A-1-b								
				G02					
				G03					
					_				
				G04					
1000-043-19 A AD.GPJ TREK.GDT 2/24/22									
g −1.5−	SILT and CLAY - trace sand			+					
₽	- light brown, moist, firm	to stiff, intermediate plasticity		G05	•	△•			
19	- AASHTO: A-7-6 (I) CLAY - silty								
904	- brown								
	moist, stiffhigh plasticity			G06					
% -2.0−	- AĂSHTO: A-7-6 (I)								
E 22									
J. KAG				007					
PA				G07		40			
REE	END OF TEST HOLE AT 2.3 1) No seepage or sloughing of	m IN CLAY							
AL ST	Test hole open to 2.3 m im	mediately after drilling.	- A - Ir Ir - IA						
LOC/	Test hole backfilled with au Test hole located in front of	uger cuttings, granular fill and cold p f #147 Canora st, Southbound lane,	atcn aspnait. , 1.5 m East of West						
80-5	curb.								
022-0									
GS 2(
Ō									
507									
FACE									
SUB-SURFACE LOG LOGS 2022-02-08_LOCAL STREET PACKAGE 22-R-05_00_0000000000000000000000000000000									
Logged By:	Asad Dustmamatov	Reviewed By: Angela F	idler-Kliewer	_ Project	Engineer: Nelson Ferr	reira			



1 of 1

GENTECHNICAL

Sub-Surface Log

Clie	nt:	WSP Canada	a Inc			Project Number:	1000-043	3-19			
Proj	ect Nam	e: Local Street	Package 22-R-05			Location:	UTM N-5	527237, E-6	31744 (Canor	a Street)	
Con	tractor:	Maple Leaf D	Drilling Ltd.			Ground Elevation:	Top of Pa	avement			
Met	hod:	125mm Solid Ste	em Auger, B40 Mobile	Truck Mount		Date Drilled:	February	8, 2022			
	Sample	е Туре:	Grab (G)	Sh	nelby Tube (T)	Split Spoon (S	SS) / SPT	Split B	Barrel (SB) / LF	т 🔳	Core (C)
	Particle	e Size Legend:	Fines	Clay	Silt	Sand	G	ravel 5%	Cobbles	Воц	ulders
-			ZYYYY	· · ·		L • • • •		I □ Bu	lk Unit Wt	Undrai	ined Shear
Depth (m)	Soil Symbol			TERIAL DESCR	IPTION		Sample Type Sample Number	16 17 18 Particl 0 20 40 PL 0 20 40	(SN/m³) 19 20 21 le Size (%) 0 60 80 100 MC LL 0 60 80 100	<u>Tes</u> △ To ♣ Pocl ⊠ ○ Fiel	igth (kPa) st Type orvane △ ket Pen. ♣ Qu ⊠ Id Vane ○ 0 150 200250
-		ASPHALT - 100					PC22	-21			
F	4 4 5	CONCRETE - 90					I OZZ				
-0.5		- black				organics	G08	8			
 - -							G09	9			
- 1.0 - 1.0		- grey no organi	cs and no gravel b	elow 12 m			G10	0		△•	
1000-043-19_A_AD.GPJ_TREK.GDT_2/24/22		SILT and CLAY	-				G1	1 •		4	
19 A AD		light browrAASHTO:	n, moist, firm, inter A-7-6 (I)		у		G12	2		4	
		- grey - moist, firm - high plasti - AASHTO:	city	ornare)			G1:	3	•	4	
T PACKAGE 22-F			· · · · · · · · · · · · · · · · · · ·				G14	4	•	Δ Φ	
SUB-SURFACE LOG LOGS 2022-02-08_LOCAL STREET PACKAGE 22-R-05.		1) No seepage of 2) Test hole ope 3) Test hole bac 4) Test hole loca curb.	HOLE AT 2.3 m IN or sloughing observ n to 2.3 m immedia kfilled with auger o ated in front of #169 ple was collected b	ved. ately after drilling uttings, granular G Canora st, Sou	fill and cold pa thbound lane,	1.5 m East of West					
Log	ged By:	Asad Dustmam	natov	_ Reviewed I	3y: <u>Angela Fi</u>	dler-Kliewer	Proj	ect Enginee	r: Nelson Fe	reira	



1 of 1

GENTECHNICOL

Sub-Surface Log

Client:	-	WSP Canad	a Inc						Pro	ject Numb	er:	1000-	043-19)						
Project	Name:	Local Street	Package	22-R-05					Loc	cation:	-	UTM	N-5527	7316, E	-63174	7 (Can	ora Str	eet)		
Contrac	tor:	Maple Leaf [Orilling Lt	td.					Gro	ound Eleva	tion:	Top o	f Pave	ment						
Method:	: .	125mm Solid St	em Auger,	B40 Mobile	Truck Mo	unt			Dat	e Drilled:	-	Febru	ary 8,	2022						
Sa	ample T	уре:		Grab (G)			Shelby	Tube (T)		Split Spo	on (S				t Barrel	(SB) /	LPT [Core (C)
Pa	article Si	ze Legend:		Fines		Clay		Silt		San San	d		Grav	-		obbles	• 7	Во	ulders	
Depth (m)	Soil Symbol	PHALT - 70 r	mm thick		TERIA	L DESC	CRIPTI	ON				Sample Type	Sample Number	Pa Pa D 20 PL	Bulk Uni (kN/m³) 18 19 rticle Size 40 60 40 60	20 2 (%) 80 10	00	Stren	ned Sho gth (kPa st Type orvane ∠ ket Pen Qu ⊠ d Vane 0 150	a) ∆ . •
		NCRETE - 1											C22-22							
-0.5-	CL	AY - silty, trade - black - frozen to - high plast - AASHTO:	1.5 m de icity	pth, moist		n to ve	ry stiff v	when thav	ved				G15	•						
-1.0-													G16	•				16		
REK.GDT 2/24/22	- b	rown, no orga	inics belo	ow 1.1 m									G18	•)			△•		
1000443-19 A AD GPJ TREK GDT 2/24/22													G19	•	•			Δ.	B	
		T and CLAY											G20		•			△ •		
PACKAGE 22-	Sil	- light brow - intermedia - AASHTO:	ate plasti	city									G21		•		4	9		
SUB-SURFACE LOG LOGS 2022-02-08_LOCAL STREET PACKAGE 22-R-05 D D D D D D D D D D D D D	1) 2) 3) 4) cur	D OF TEST I No seepage of Test hole ope Test hole bace Test hole loca b. The bulk sam	or slough in to 2.3 kfilled wa ated in fr	ning obser m immedi ith auger o ont of #18	ved. ately af cuttings 9 Cano	ter drilli , granul ra st, N	ng. lar fill a orthbo	und lane,	1.5 m	sphalt. West of Ea	ast			,						
Logged	By : _A	sad Dustman	natov		_ R	eviewe	d By:	Angela F	idler-k	(liewer		_ F	Project	Engin	eer: N	lelson F	erreira	a		



2022 Local Street Package - 22-R-05 Sub-Surface Investigation

Canora Street: between Preston Avenue and Westminster Avenue

Test Hole Test Hole Location		Paveme	ent Surface	Pavement Str	ucture Material		Sample	Depth (m)	Moisture		Grain Siz	e Analysis	3	At	terberg L	imits
No.	l est Hole Location	Туре	Thickness (mm)	Туре	Thickness (mm) Subgrade Description		Top (m)	Bottom (m)	Content (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
		Asphalt	100	Concrete	80	Sand; AASHTO: A-1-b	0.3	0.5	7							
	UTM : 14U 5527163 N,					Sand; AASHTO: A-1-b	0.6	0.8	6							
	631741 E					Sand; AASHTO: A-1-b	0.9	1.1	5	17	7.0	56.0	27.0			
TH22-01	Located in front of #147 Canora St., Southbound					Sand; AASHTO: A-1-b	1.2	1.4	6							
	lane, 1.5 m East of West					Silt and Clay; AASHTO: A-7-6 (I)	1.5	1.7	39							
	curb.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	41							
						Clay; AASHTO: A-7-6 (I)	2.1	2.3	45							
		Asphalt	100	Concrete	90	Clay; AASHTO: A-7-6 (59)	0.3	0.5	26							
	UTM : 14U 5527237 N,					Clay; AASHTO: A-7-6 (59)	0.6	0.8	33							
	631744 E					Clay; AASHTO: A-7-6 (59)	0.9	1.1	34	64	26	9	1	21	80	59
TH22-02	Located in front of #169 Canora St., Southbound					Clay; AASHTO: A-7-6 (59)	1.2	1.4	37							
	lane, 1.5 m East of West					Silt and Clay; AASHTO: A-7-6 (I)	1.5	1.7	41							
	curb.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	47							
						Clay; AASHTO: A-7-6 (I)	2.1	2.3	48							
		Asphalt	70	Concrete	140	Clay; AASHTO: A-7-6 (I)	0.3	0.5	27							
	UTM : 14U 5528209 N,					Clay; AASHTO: A-7-6 (I)	0.6	0.8	27							
	630791 E					Clay; AASHTO: A-7-6 (I)	0.9	1.1	27							
TH22-03	Located in front of #189 Canora St., Northbound					Clay; AASHTO: A-7-6 (I)	1.2	1.4	29							
	lane, 1.5 m West of East					Clay; AASHTO: A-7-6 (I)	1.5	1.7	33							
	curb.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	41							
						Silt and Clay; AASHTO: A-7-6 (I)	2.1	2.3	36							

⁽I) - AASHTO classification was interpreted based on visual classification.



Project No. 1000-043-19
Client WSP Canada Inc

Project Street Package 22-R-05-Canora Street

Sample Date07-Feb-22Test Date09-Feb-22TechnicianAD

Test Hole	TH22-01	TH22-01	TH22-01	TH22-01	TH22-01	TH22-01
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0
Sample #	G01	G02	G03	G04	G05	G06
Tare ID	F58	E35	FUPA	A106	K20	P08
Mass of tare	8.7	8.5	232.2	8.3	8.6	8.6
Mass wet + tare	198.1	214.1	1258.3	257.2	290.2	254.7
Mass dry + tare	185.4	203.2	1211.1	244.2	210.7	182.9
Mass water	12.7	10.9	47.2	13.0	79.5	71.8
Mass dry soil	176.7	194.7	978.9	235.9	202.1	174.3
Moisture %	7.2%	5.6%	4.8%	5.5%	39.3%	41.2%

Test Hole	TH22-01	TH22-02	TH22-02	TH22-02	TH22-02	TH22-02
Depth (m)	2.1 - 2.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7
Sample #	G07	G08	G09	G10	G11	G12
Tare ID	W48	Z114	Z93	K28	W07	D45
Mass of tare	8.4	8.3	8.5	8.5	8.4	8.5
Mass wet + tare	174.8	251.9	230.5	413.1	165.3	237.1
Mass dry + tare	123.5	201.7	175.1	310.3	123.2	171.0
Mass water	51.3	50.2	55.4	102.8	42.1	66.1
Mass dry soil	115.1	193.4	166.6	301.8	114.8	162.5
Moisture %	44.6%	26.0%	33.3%	34.1%	36.7%	40.7%

Test Hole	TH22-02	TH22-02	TH22-03	TH22-03	TH22-03	TH22-03
Depth (m)	1.8 - 2.0	2.1 - 2.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4
Sample #	G13	G14	G15	G16	G17	G18
Tare ID	N113	F16	D5	D50	AB84	E106
Mass of tare	8.6	8.4	8.2	8.4	6.5	8.5
Mass wet + tare	154.4	229.8	208.2	182.8	195.5	205.7
Mass dry + tare	107.6	157.6	165.6	146.1	155.0	162.0
Mass water	46.8	72.2	42.6	36.7	40.5	43.7
Mass dry soil	99.0	149.2	157.4	137.7	148.5	153.5
Moisture %	47.3%	48.4%	27.1%	26.7%	27.3%	28.5%



Project No. 1000-043-19
Client WSP Canada Inc

Project Street Package 22-R-05-Canora Street

Sample Date07-Feb-22Test Date09-Feb-22TechnicianAD

Test Hole	TH22-03	TH22-03	TH22-03	3
Depth (m)	1.5 - 1.7	1.8 - 2.0	2.1 - 2.3	3
Sample #	G19	G20	G21	1
Tare ID	AB51	E87	E22	2
Mass of tare	6.6	8.5	8.7	7
Mass wet + tare	262.1	237.7	262.0	
Mass dry + tare	198.4	171.2	194.8	3
Mass water	63.7	66.5	67.2	2
Mass dry soil	191.8	162.7	186.1	1
Moisture %	33.2%	40.9%	36.1%	6



www.trekgeotechnical.ca 1712 St. James Street Winnipeg, MB R3H 0L3

Tel: 204.975.9433 Fax: 204.975.9435

Atterberg Limits ASTM D4318-10e1

 Project No.
 1000-043-19

 Client
 WSP Canada Inc

Project Local Street Package 22-R-05 - Canora Street

Test Hole TH22-02
Sample # G10
Poeth (m) 0.9 - 1.1

 Depth (m)
 0.9 - 1.1

 Sample Date
 07-Feb-22

 Test Date
 11-Feb-22

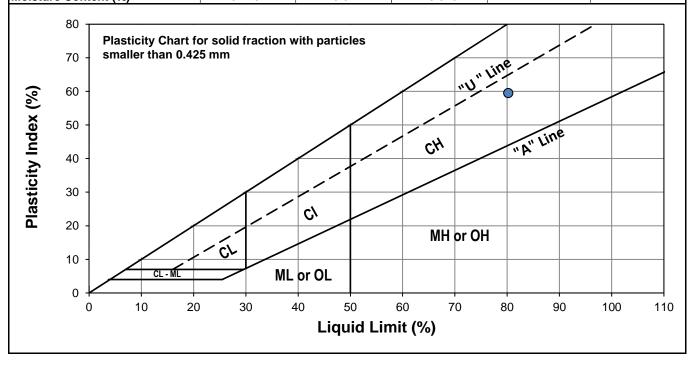
 Technician
 AD



Liquid Limit 80
Plastic Limit 21
Plasticity Index 59

Liquid Limit

Liquid Lillin				
Trial #	1	2	3	
Number of Blows (N)	15	27	33	
Mass Tare (g)	14.114	14.084	14.056	
Mass Wet Soil + Tare (g)	23.356	24.408	23.119	
Mass Dry Soil + Tare (g)	19.129	19.835	19.147	
Mass Water (g)	4.227	4.573	3.972	
Mass Dry Soil (g)	5.015	5.751	5.091	
Moisture Content (%)	84.287	79.517	78.020	



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.177	14.114			
Mass Wet Soil + Tare (g)	21.322	21.370			
Mass Dry Soil + Tare (g)	20.096	20.127			
Mass Water (g)	1.226	1.243			
Mass Dry Soil (g)	5.919	6.013			
Moisture Content (%)	20.713	20.672			



Project No. 1000-043-19
Client WSP Canada Inc.

Project Local Street Package 22-R-05-Canora Street

 Test Hole
 TH22-02

 Sample #
 G10

 Depth (m)
 0.9 - 1.1

 Sample Date
 7-Feb-22

 Test Date
 11-Feb-22

 Technician
 NM



Gravel	0.3%
Sand	9.3%
Silt	26.3%
Clay	64.2%

Particle Size Distribution Curve Sand Gravel Silt Clay Coarse Fine Fine Medium 100 90 80 Percent Finer by Weight 70 60 50 40 30 20 10 0 0.001 0.01 0.1 10 100 Particle Size (mm)

Gra	avel	Sa	ınd	Silt an	d Clay
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	99.74	0.0750	90.47
37.5	100.00	2.00	99.49	0.0548	85.29
25.0	100.00	0.850	97.78	0.0396	80.62
19.0	100.00	0.425	96.52	0.0284	77.82
12.5	100.00	0.180	95.02	0.0180	77.20
9.50	100.00	0.150	94.67	0.0142	76.89
4.75	99.74	0.075	90.47	0.0105	74.77
				0.0074	73.90
				0.0053	72.41
				0.0038	70.55
				0.0026	67.06
				0.0019	63.90
				0.0011	59.48

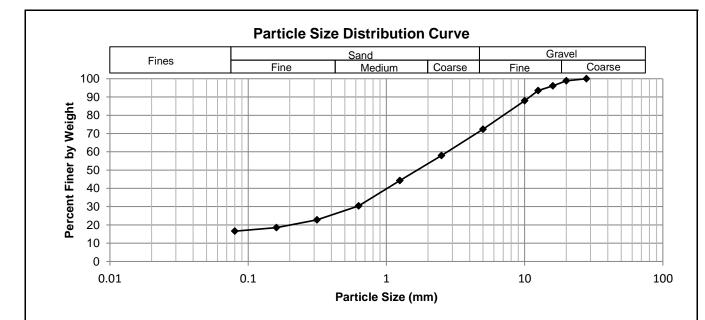


Project No. 1000-043-19 Client WSP Canada Inc.

Project Local Street Package 22-R-05 - Canora Street

Test Hole TH22-01 Sample # G03 Depth (m) 0.9-1.1 Date Sampled 7-Feb-22 **Date Tested** 10-Feb-22 Technician NM

Total Weight (g)	978.0
Gravel %	27.6
Sand %	55.8
Fines %	16.6



Sieve Opening (mm)	Percent Passing	Specification (Min-Max)		
28.0	100	-		
20.0	99	-		
16.0	96	-		
12.5	93	-		
10.0	88	-		
5.0	72	-		
2.50	58	-		
1.25	44	-		
0.630	30	-		
0.315	23	-		
0.160	19	-		
0.080	17	-		



Project No. 1000-043-19

Client WSP

Project 2022 Local Streets Package

Sample # Combined bulk samples

RS

Source TH22-02, 03

Material Clay

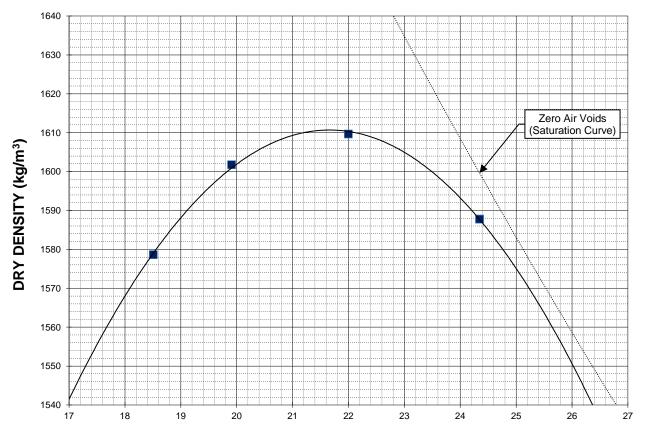
Technician

Sample Date 07-Feb-22 Test Date 10-Feb-22



Maximum Dry Density (kg/m3)	1611
Optimum Moisture (%)	21.7

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1871	1921	1964	1974	
Dry Density (kg/m ³)	1579	1602	1610	1588	
Moisture Content (%)	18.5	19.9	22.0	24.3	



MOISTURE CONTENT (%)



California Bearing Ratio Test Data Sheet ASTM D1883-16

Project No. 1000-043-19 **Source** TH22-02, 03

Client WSP Material Clay

Project2022 Local Streets PackageSample Date2022-02-07Sample #Bulk (Canora St)Test Date2022-02-11

Technician DS

Proctor Results (ASTM D698) CBR Sample Compaction

Maximum Dry Density 1611 kg/m3 Dry Density 1528 kg/m3
Optimum Moisture Content 21.7 % Initial Moisture Content 22.7 %

Material Retained on 19 mm Sieve 0.0 % Relative Density 94.8 % SPMDD

Soaking Results CBR Results

 Surcharge
 4.54 kg
 CBR at 2.54 mm
 5.5 %

 Swell
 0.5 %
 CBR at 5.08 mm
 4.4 %

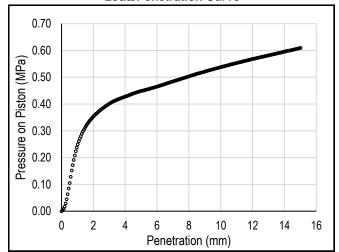
 Moisture Content in top 25 mm
 26.6 %
 Zero Correction
 0 mm

Immersion Period 96 h

Test Data

Measured Corrected Penetration (mm) Pressure (MPa) Pressure (MPa) 0.15 0.15 0.64 0.29 0.29 1.27 0.35 0.35 1.91 2.54 0.38 0.38 0.41 3.18 0.41 3.81 0.42 0.42 4.45 0.44 0.44 5.08 0.45 0.45 7.62 0.50 0.50 0.54 0.54 10.16 12.70 0.58 0.58

Load/Penetration Curve



Comments:





Photo 1: Pavement Core Sample at Test Hole TH22-01



Photo 2: Pavement Core Sample at Test Hole TH22-02

Project No. 1000 043 19 February 2022





Photo 3: Pavement Core Sample at Test Hole TH22-03



Appendix B

Test Hole Logs, Summary Table & Lab Testing Results and Pavement Core Photos – Downing Street



EXPLANATION OF FIELD AND LABORATORY TESTING

GENERAL NOTES

- 1. Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- 2. Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- 3. When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Ma	jor Div	isions	USCS Classi- fication	Symbols	Typical Names		Laboratory Classific	cation Criteria		ς,			
	action	gravel no fines)	GW	36	Well-graded gravels, gravel-sand mixtures, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ greater than 4	4; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3		ASTM Sieve sizes	#10 to #4	#40 to #10	< #200
sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	Clean gravel (Little or no fines)	GP	.A.	Poorly-graded gravels, gravel-sand mixtures, little or no fines	urve, 200 sievej nbols*	Not meeting all gradation	requirements for GW	0	STMS	#10	#40 t	* V
No. 200 s	Gray than half o	Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	rain size c r than No. g dual sym	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are border-	Particle Size	⋖			
ained soils larger thar	(More	Gravel w (Appre amount	GC		Clayey gravels, gravel-sand-silt mixtures	vel from g on smaller llows: W, SP SM, SC SM, SC	Atterberg limits above "A" line or P.I. greater than 7	line cases requiring use of dual symbols	Part		22	00 ۾د	9
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	action	sands no fines)	SW	****	Well-graded sands, gravelly sands, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction snaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP More than 12 percent GM, GC, SM, SC 6 to 12 percent Borderline case4s requiring dual symbols*	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6	$C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3		E	2.00 to 4.75	0.425 to 2.00	< 0.075
half the r	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (Little or no fines)	SP		Poorly-graded sands, gravelly sands, little or no fines	ages of sarentage of farentage of farentage of farentage of farentage.	Not meeting all gradation	requirements for SW			•	0 0	<i>i</i>
(More than	Sar than half c	Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures	ne percentarion percentarion percentarion percentarion percentarion percentarion percentarion 12 percentarion	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are border-	rial				Clay
	(More	Sands w (Appre amount	SC		Clayey sands, sand-clay mixtures	Determin dependin coarse-g Less t More	Atterberg limits above "A" line or P.I. greater than 7	line cases requiring use of dual symbols	Material	0000	Coarse	Medium	Silt or Clay
size)	ys.		ML		Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity	80 Plasticity	Plasticity (Chart	i	Sizes	. <u>.</u> . <u>.</u> :	2	i ii
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silts and Clar	(Liquid limit less than 50)	CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	70 – 60 –	an 0.425 mm	"I III" I III	9	ASTM Sieve Sizes	3 in. to 12 in.	3/4 in 40 3 in	3/4 III. (0 3 III #4 to 3/4 in.
soils er than No	is.	<u> </u>	OL		Organic silts and organic silty clays of low plasticity	NDEX (%)		CA CA	Particle Size	AS			_
e-Grained al is small	iys	t 50)	MH	Ш	Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts	PLASTICITY INDEX				mm *300	75 to 300	 	19 to 75 4.75 to 19
Fine the materi.	ts and Cla	(Liquid limit greater than 50)	СН		Inorganic clays of high plasticity, fat clays	20 -	0	MH OR OH		<u>-</u>	75 tu		4.75
than half	<u> </u>		ОН		Organic clays of medium to high plasticity, organic silts	7 4 0 10	ML or OL 16 20 30 40 50 LIQUID LIM	60 70 80 90 100 110 IIT (%)	rial	9	S S		
(More	Highly	Organic Soils	Pt	6 46 46 47 47 4	Peat and other highly organic soils	Von Post Class		rong colour or odour, nd often fibrous texture	Material	Double	Cobbles	Gravel	Fine

^{*} Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.

Other Symbol Types

Asphalt	Bedrock (undifferentiated)	Cobbles
Concrete	Limestone Bedrock	Boulders and Cobbles
Fill	Cemented Shale	Silt Till
	Non-Cemented Shale	Clay Till



EXPLANATION OF FIELD AND LABORATORY TESTING

LEGEND OF ABBREVIATIONS AND SYMBOLS

PL - Plastic Limit (%)
PI - Plasticity Index (%)

▼ Water Level at End of Drilling

MC - Moisture Content (%)

Water Level After Drilling as Indicated on Test Hole Logs

SPT - Standard Penetration Test Indicated on Test Hole Logs
RQD - Rock Quality Designation

Su - Undrained Shear Strength VW - Vibrating Wire Piezometer

Qu - Unconfined Compression

SI - Slope Inclinometer

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE
and	and CLAY	35 to 50 percent
"y" or "ey"	clayey, silty	20 to 35 percent
some	some silt	10 to 20 percent
trace	trace gravel	1 to 10 percent

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Verv dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

Descriptive Terms	<u>SPT (N) (Blows/300 mm)</u>
Very soft	< 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very stiff	15 to 30
Hard	> 30

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Undrained Shear <u>Strength (kPa)</u>
< 12
12 to 25
25 to 50
50 to 100
100 to 200
> 200

Test Hole TH22-04

1 of 1



Client:	WSP Canada II	nc		Project Number: 1000-043-19 Location: UTM N-5528209, E-630791 (Downing Street)									
Project Name	oject Name: Local Street Package 22-R-05 ontractor: Maple Leaf Drilling Ltd.					UTM I	N-552	28209, E-	630791	(Downin	g Street)	
Contractor:	Maple Leaf Dril	ling Ltd.			Ground Elevation	: <u>Top o</u>	f Pav	ement					
Method:	125mm Solid Stem	Auger, B40 Mobile Tr	uck Mount		Date Drilled:	Febru	ary 7	, 2022					
Sample	Туре:	Grab (G)		Shelby Tube (T)	Split Spoon (SS) / SPT Split Barrel (SB) / LPT Core (C)							
Particle	Size Legend:	Fines	Clay	Silt	Sand		Gra	vel 5	Z Col	bbles	В	oulders	S
Depth (m) Soil Symbol			ERIAL DES	CRIPTION		Sample Type	amp	16 17 Part 0 20 PL	MC	20 21	Stre	ained Shength (kFest Type Forvane poket Per ☑ Qu ☑ eld Vane	Pa) <u>e</u> e ∆ en. ⊕
	CONCRETE - 180	mm thick					C22-23	B					
-0.5-	CLAY - silty, trace s - black, - frozen to 1.5 - high plasticit - AASHTO: A-	m depth, moist a		ry stiff when thaw	red		G22	•					
	- brown, no organio	cs below 0.6 m					G23	•			△•		
-1.0-							G24				•		
-1.5-							G25	•				4	
	SILT - some clay, t - light brown - moist, soft - low plasticity - AASHTO: A-	,					G26 G27						
-2.0-							G28	•					
	END OF TEST HO 1) No seepage or s 2) Test hole open t 3) Test hole backfil 4) Test hole located curb. 5) The bulk sample	sloughing observe to 2.3 m immediat lled with auger cu d in front of #821	ed. ely after drill ttings, granu Downing st,	lar fill and cold pa Northbound Land	e, 1.5 m West of Eas	st							
Logged By:	Asad Dustmamat	OV	Reviewe	d By : Angela F	idler-Kliewer	F	Projec	t Engine	er: Nel	son Ferr	eira		





Clien	ıt:	WSP Canad	la Inc			Project Number:	1000-043	3-19			
Proje	ct Name	e: Local Street	Package 22-R-05			Location:	UTM N-5	528278, E-	630790 (Downii	ng Street)
Cont	ractor:	Maple Leaf [Drilling Ltd.			Ground Elevation:	Top of Pa	avement			
Meth	od:	125mm Solid St	tem Auger, B40 Mobile Tr	uck Mount		Date Drilled:	February	7, 2022			
	Sample	Туре:	Grab (G)	5	Shelby Tube (T)	Split Spoon (S	S)/SPT	Split	Barrel (SB) / LP	Т	Core (C)
	Particle	Size Legend:	Fines	///// Clay	Silt	Sand	Gı		Cobbles	В	oulders
Depth (m)	Soil Symbol	ASPHALT - 45 I		ERIAL DESC	RIPTION		Sample Type Sample Number	16 17 Parti	Bulk Unit Wt (kN/m³) 18 19 20 21 18 19 20 21 19 20 21 19 20 21 19 19 19 19 19 19 19 19 19 19 19 19 19	Stre 	ained Shear ength (kPa) est Type forvane △ cket Pen. ♣ ☑ Qu ☑ eld Vane ○ 00 150 200250
-		CONCRETE - 1					PC22	-24			
-0.5-		- black	ce sand, trace organi oist and firm when th ticity : A-7-6 (I)				G25			•	
-1.0-		SILT - some cla		m			G3 ⁻	1			
J TREK.GDT 2/24/	- - - - - - -		1.5 m depth, moist are ermediate plasticity	nd soft when	thawed		G32	2			
1000-043-19_A_AD.GPJ_TREK.GDT_2/24/22		CLAY - silty - brown - moist, stif - high plast - AASHTO:	ff to very stiff ticity : A-7-6 (I)				G33	3		Δ	0
III.							G34	4	•	∆ o	
T PACKAGE 22-F							G35	5	•	40	
SUB-SURFACE LOG LOGS 2022-02-08_LOCAL STREET PACKAGE 22-R-05_05_06_07_07_07_07_07_07_07_07_07_07_07_07_07_	2	1) No seepage of 2) Test hole ope 3) Test hole bac 4) Test hole loca curb.	HOLE AT 2.3 m IN C or sloughing observe en to 2.3 m immediate ckfilled with auger cut ated in front of #857 aple was collected be	ed. ely after drillir ttings, granula Downing st, S	ar fill and cold pa Southbound lane	, 1.5 m East of West					
Logg	ed By:	Asad Dustman	natov	Reviewed	By: Angela Fi	dler-Kliewer	_ Proje	ect Engine	er: Nelson Fer	reira	





Client:		WSP Canad	la Inc				Project Number:	1000-04	3-19				
Project	Name:	Local Street	Package 22-R-0	5			Location:	UTM N-	55283	52, E-63079	95 (Downin	g Street	.)
Contrac	ctor:	Maple Leaf I	Drilling				Ground Elevation:	Top of P	Paveme	ent			
Method	i:	125mm Solid S	tem Auger, B40 Mobi	le Truck Mount			Date Drilled:	February	y 7, 20	22			
Sa	ample T	уре:	Grab (G)	Shelb	y Tube (T)	Split Spoon (S	SS) / SPT		Split Barre	l (SB) / LP1		Core (C)
Pa	article S	Size Legend:	Fines	CI	ay 📗	Silt	Sand		Gravel		Cobbles	В	oulders
1000-043-19_A_AD.GPJ_TREK.GDT_2/24/22 1000-043-19_A_AD.GPJ_TREK.GDT_2/24/22 1000-043-19_A_AD.GPJ_TREK.GDT_2/24/22 1000-043-19_A_AD.GPJ_TREK.GDT_2/24/22 1000-043-19_A_AD.GPJ_TREK.GDT_2/24/22 1000-043-19_A_A_AD.GPJ_TREK.GDT_2/24/22 1000-043-19_A_A_AD.GPJ_TREK.GDT_2/24/22 1000-043-19_A_A_AD.GPJ_TREK.GDT_2/24/22 1000-043-19_A_A_AD.GPJ_TREK.GDT_2/24/22 1000-043-19_A_A_A_A_A_A_A_A_A_A_A_A_A_A_A_A_A_A_A	article S oquinos oqu	AY - silty, tra - black, fro: - AASHTO LT - some cla - light brow - frozen, m - low plasti - AASHTO	Fines Fines Fines Fines Fines Fines N Fines Fines N Fines Fines Fines Fines Fines Fines N Fines Fin	m when that	ay [ION Silt		ed Gample Type Co	36 37 38 39 40 41	Bulk Un 17 18 1 Particle Siz 20 40 6	Cobbles it Wt	B Undr Street	oulders rained Shear rength (kPa) rest Type Torvane \(\Delta\) coket Pen. \(\Delta\) Rest Ou \(\Delta\)
PAC -								G4	42			6	
SUB-SURFACE LOG LOGS 2022-02-08_LOCAL STREET PACKAGE 22-R-05_0000000000000000000000000000000000	1) 2) 3) 4) cu	No seepage Test hole operated hole local rest.	HOLE AT 2.3 m lor sloughing obsen to 2.3 m immeckfilled with auge ated in front of #8	erved. diately after r cuttings, gr 889 Downing	ranular fill g st, Northl	oound lane,	1.5 m West of East						
Logged	d By: _/	Asad Dustmar	matov	Revi	ewed By:	Angela Fi	dler-Kliewer	_ Pro	ject E	ngineer: _1	Nelson Ferr	eira	



2022 Local Street Package - 22-R-05 Sub-Surface Investigation Downing Street- between Ellice Avenue and Armoury Avenue

Test Hole		Paveme	ent Surface	Pavement Str	ucture Material		Sample	Depth (m)	Moisture		Grain Siz	e Analysis	3	Atterberg Limits		
No.	Test Hole Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Subgrade Description	Top (m)	Bottom (m)	Content (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
		Asphalt	-	Concrete	180	Clay; AASHTO: A-7-6 (50)	0.3	0.5	25							
	UTM : 14U 5528209 N,					Clay; AASHTO: A-7-6 (50)	0.6	0.8	27							
TH22-04	630791 E					Clay; AASHTO: A-7-6 (50)	0.9	1.1	28	56	43	1	0	19	64	45
	Located in front of #821 Downing St., Northbound					Clay; AASHTO: A-7-6 (50)	1.2	1.4	29							
	lane, 1.5 m West of East					Silt; AASHTO: A-4 (I)	1.5	1.7	23							
	curb.					Silt; AASHTO: A-4 (I)	1.8	2.0	23							
						Silt; AASHTO: A-4 (I)	2.1	2.3	22							
		Asphalt	45	Concrete	175	Clay; AASHTO: A-7-6 (I)	0.3	0.5	36							
	UTM : 14U 5528278 N.					Clay; AASHTO: A-7-6 (I)	0.6	0.8	33							
	630790 E Located in front of #857 Downing St., Southbound lane, 1.5 m East of West					Clay; AASHTO: A-7-6 (I)	0.9	1.1	31							
TH22-05						Silt; AASHTO: A-4 (I)	1.2	1.4	23							
						Clay; AASHTO: A-7-6 (I)	1.5	1.7	36							
	curb.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	39							
						Clay; AASHTO: A-7-6 (I)	2.1	2.3	45							
		Asphalt	20	Concrete	190	Clay; AASHTO: A-7-6 (I)	0.3	0.5	33							
	UTM : 14U 5528352 N,					Silt; AASHTO: A-4 (3)	0.6	0.8	30							
	630790 E					Silt; AASHTO: A-4 (3)	0.9	1.1	23	14	81	5	0	18	23	5
TH22-06	Located in front of #889 Downing St., Northbound					Clay; AASHTO: A-7-6 (I)	1.2	1.4	33							
	lane, 1.5 m West of East					Clay; AASHTO: A-7-6 (I)	1.5	1.7	38							
	curb.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	41							
						Clay; AASHTO: A-7-6 (I)	2.1	2.3	52							

⁽I) - AASHTO classification was interpreted based on visual classification.

Project Street Package 22-R-05- Downing Street

Sample Date07-Feb-22Test Date09-Feb-22TechnicianAD

Test Hole	TH22-04	TH22-04	TH22-04	TH22-04	TH22-04	TH22-04
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0
Sample #	G22	G23	G24	G25	G26	G27
Tare ID	Z36	Z13	W35	W10	H16	Z22
Mass of tare	8.3	8.6	8.2	8.4	8.4	8.3
Mass wet + tare	292.7	288.4	414.4	283.1	262.2	240.6
Mass dry + tare	236.2	229.7	326.8	221.8	214.0	198.0
Mass water	56.5	58.7	87.6	61.3	48.2	42.6
Mass dry soil	227.9	221.1	318.6	213.4	205.6	189.7
Moisture %	24.8%	26.5%	27.5%	28.7%	23.4%	22.5%

Test Hole	TH22-04	TH22-05	TH22-05	TH22-05	TH22-05	TH22-05
Depth (m)	2.1 - 2.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7
Sample #	G28	G29	G30	G31	G32	G33
Tare ID	Z47	F100	W26	N35	Z85	N54
Mass of tare	8.5	8.3	8.2	8.4	8.3	8.5
Mass wet + tare	199.1	339.8	255.1	386.2	235.9	357.2
Mass dry + tare	164.5	252.9	193.8	297.4	193.1	264.6
Mass water	34.6	86.9	61.3	88.8	42.8	92.6
Mass dry soil	156.0	244.6	185.6	289.0	184.8	256.1
Moisture %	22.2%	35.5%	33.0%	30.7%	23.2%	36.2%

Test Hole	TH22-05	TH22-05	TH22-06	TH22-06	TH22-06	TH22-05
Depth (m)	1.8 - 2.0	2.1 - 2.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4
Sample #	G34	G35	G36	G37	G38	G39
Tare ID	N22	N75	N02	AB78	Z78	H66
Mass of tare	8.5	8.5	8.6	6.6	8.4	8.3
Mass wet + tare	241.3	235.0	244.2	203.2	473.2	211.5
Mass dry + tare	176.6	165.1	185.3	158.3	385.5	161.4
Mass water	64.7	69.9	58.9	44.9	87.7	50.1
Mass dry soil	168.1	156.6	176.7	151.7	377.1	153.1
Moisture %	38.5%	44.6%	33.3%	29.6%	23.3%	32.7%



Project Street Package 22-R-05- Downing Street

Sample Date07-Feb-22Test Date09-Feb-22TechnicianAD

Test Hole	TH22-06	TH22-05	TH22-06		
Depth (m)	1.5 - 1.7	1.8 - 2.0	2.1 - 2.3		
Sample #	G40	G41	G42		
Tare ID	N41	H80	Z39		
Mass of tare	8.4	8.6	8.4		
Mass wet + tare	270.6	225.9	220.2		
Mass dry + tare	198.4	162.6	147.8		
Mass water	72.2	63.3	72.4		
Mass dry soil	190.0	154.0	139.4		
Moisture %	38.0%	41.1%	51.9%		



www.trekgeotechnical.ca 1712 St. James Street Winnipeg, MB R3H 0L3

Tel: 204.975.9433 Fax: 204.975.9435

Atterberg Limits ASTM D4318-10e1

 Project No.
 1000-043-19

 Client
 WSP Canada Inc

Project Local Street Package 22-R-05-Downing Street

 Test Hole
 TH22-04

 Sample #
 G24

Depth (m) 0.9 - 1.1

Sample Date 07-Feb-22

Test Date 11-Feb-22

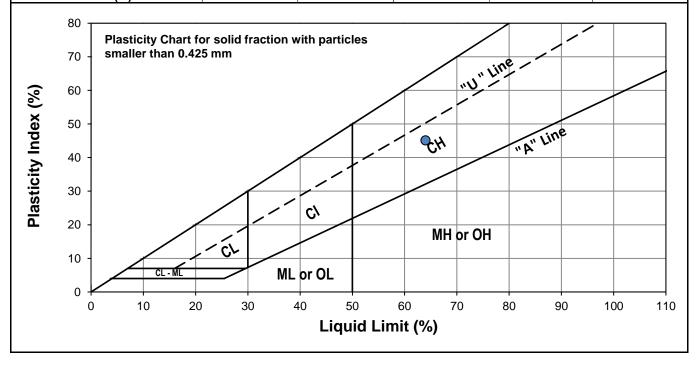
Technician AD



Liquid Limit 64
Plastic Limit 19
Plasticity Index 45

Liquid Limit

Trial #	1	2	3	
Number of Blows (N)	18	29	34	
Mass Tare (g)	13.864	14.025	14.061	
Mass Wet Soil + Tare (g)	24.972	25.696	24.821	
Mass Dry Soil + Tare (g)	20.560	21.169	20.706	
Mass Water (g)	4.412	4.527	4.115	
Mass Dry Soil (g)	6.696	7.144	6.645	
Moisture Content (%)	65.890	63.368	61.926	



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.107	14.062			
Mass Wet Soil + Tare (g)	20.358	21.513			
Mass Dry Soil + Tare (g)	19.359	20.340			
Mass Water (g)	0.999	1.173			
Mass Dry Soil (g)	5.252	6.278			
Moisture Content (%)	19.021	18.684			



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or specific tests as listed on www.ccil.co

Project No. <u>1000-043-19</u>

Client WSP Canada Inc

Project Local Street Package 22-R-05-Downing Street

 Test Hole
 TH22-06

 Sample #
 G38

Depth (m) 0.9 - 1.1

Sample Date 07-Feb-22

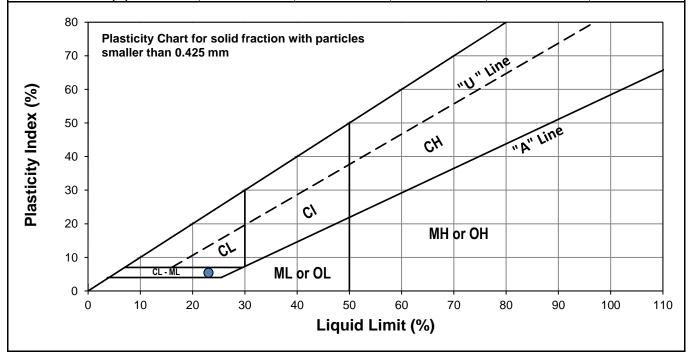
Test Date 11-Feb-22

Technician AD

Liquid Limit 23
Plastic Limit 18
Plasticity Index 5

Liquid Limit

Liquid Limit						
Trial #	1	2	3			
Number of Blows (N)	19	25	33			
Mass Tare (g)	14.174	13.919	14.183			
Mass Wet Soil + Tare (g)	26.352	24.563	31.100			
Mass Dry Soil + Tare (g)	23.970	22.577	28.066			
Mass Water (g)	2.382	1.986	3.034			
Mass Dry Soil (g)	9.796	8.658	13.883			
Moisture Content (%)	24.316	22.938	21.854			



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.937	14.153			
Mass Wet Soil + Tare (g)	22.145	23.572			
Mass Dry Soil + Tare (g)	20.925	22.150			
Mass Water (g)	1.220	1.422			
Mass Dry Soil (g)	6.988	7.997			
Moisture Content (%)	17.459	17.782			



Project Local Street Package 22-R-05-Downing Street

 Test Hole
 TH22-04

 Sample #
 G24

 Depth (m)
 0.9 - 1.1

 Sample Date
 7-Feb-22

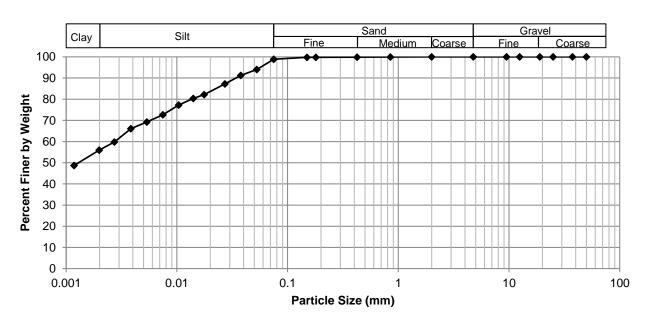
 Test Date
 11-Feb-22

 Technician
 NM



Gravel	0.0%
Sand	1.2%
Silt	42.8%
Clay	56.0%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	98.84
37.5	100.00	2.00	100.00	0.0527	94.03
25.0	100.00	0.850	99.92	0.0378	91.27
19.0	100.00	0.425	99.88	0.0272	87.21
12.5	100.00	0.180	99.79	0.0176	82.21
9.50	100.00	0.150	99.75	0.0141	80.33
4.75	100.00	0.075	98.84	0.0104	77.26
				0.0075	72.62
				0.0054	69.24
				0.0038	66.11
				0.0027	59.80
				0.0020	55.96
				0.0012	48.71



Project Local Street Package 22-R-05-Downing Street

 Test Hole
 TH22-06

 Sample #
 G38

 Depth (m)
 0.9 - 1.1

 Sample Date
 7-Feb-22

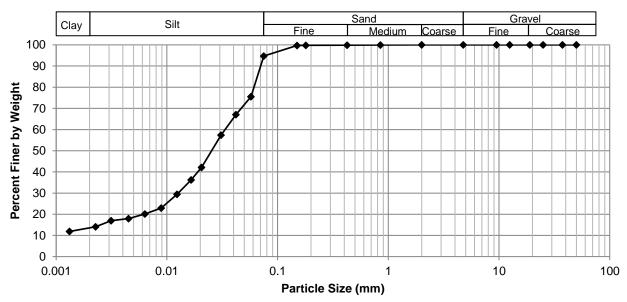
 Test Date
 11-Feb-22

 Technician
 NM



Gravel	0.0%
Sand	5.3%
Silt	81.3%
Clay	13.4%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	94.71
37.5	100.00	2.00	99.99	0.0575	75.52
25.0	100.00	0.850	99.91	0.0421	67.08
19.0	100.00	0.425	99.86	0.0309	57.39
12.5	100.00	0.180	99.75	0.0206	42.15
9.50	100.00	0.150	99.71	0.0166	36.21
4.75	100.00	0.075	94.71	0.0124	29.40
				0.0089	22.91
				0.0063	20.17
				0.0045	17.98
				0.0031	16.97
				0.0023	14.07
				0.0013	11.88



Project No. 1000-043-19

Client WSP

Project 2022 Local Streets Package

Sample # Combined bulk samples
Source TH22-04, 05, 06 (Downing St.)

RS

Material Clay

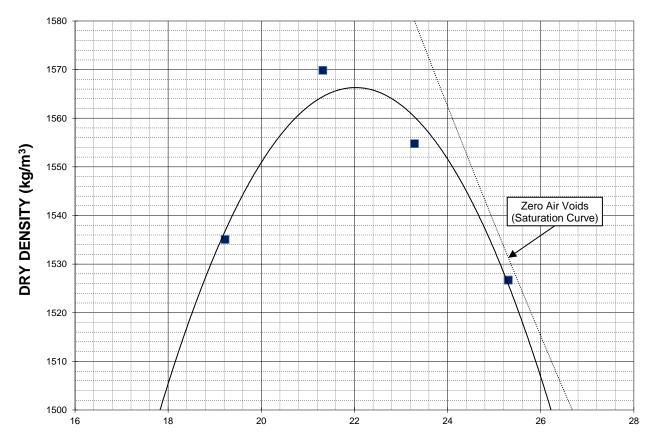
Technician

Sample Date07-Feb-22Test Date10-Feb-22



Optimum Moisture (%)	22.0
Maximum Dry Density (kg/m3)	1566

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1830	1905	1917	1913	
Dry Density (kg/m³)	1535	1570	1555	1527	
Moisture Content (%)	19.2	21.3	23.3	25.3	



MOISTURE CONTENT (%)



California Bearing Ratio Test Data Sheet ASTM D1883-16

Project No. 1000-043-19 **Source** TH22-04,05,06

Client WSP Material Clay

Project2022 Local Streets PackageSample Date2022-02-07Sample #Bulk (Downing Street)Test Date2022-02-16

Technician RS

Proctor Results (ASTM D698) CBR Sample Compaction

Maximum Dry Density 1566 kg/m3 Dry Density 1478 kg/m3
Optimum Moisture Content 22.0 % Initial Moisture Content 23.5 %

Material Retained on 19 mm Sieve 0.0 % Relative Density 94.4 % SPMDD

Soaking Results CBR Results

 Surcharge
 4.54 kg
 CBR at 2.54 mm
 2.3 %

 Swell
 1.3 %
 CBR at 5.08 mm
 1.9 %

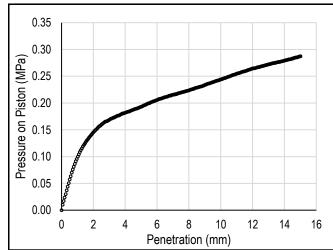
 Moisture Content in top 25 mm
 35.2 %
 Zero Correction
 0 mm

Immersion Period 96 h

Test Data

Measured Corrected Penetration (mm) Pressure (MPa) Pressure (MPa) 0.07 0.07 0.64 1.27 0.12 0.12 1.91 0.14 0.14 2.54 0.16 0.16 3.18 0.17 0.17 3.81 0.18 0.18 4.45 0.19 0.19 5.08 0.19 0.19 7.62 0.22 0.22 0.25 0.25 10.16 12.70 0.27 0.27

Load/Penetration Curve



Comments:



Project No. 1000-043-19

Client **WSP**

Project 2022 Local Streets Package

Sample # Combined bulk samples Source TH22-05, 06 (Downing St.)

2030

1741

Material Silt

Wet Density (kg/m³)

Dry Density (kg/m³)

07-Feb-22 Sample Date Test Date 10-Feb-22

Maximum Dry Density (kg/m3) 1756

2018

1649

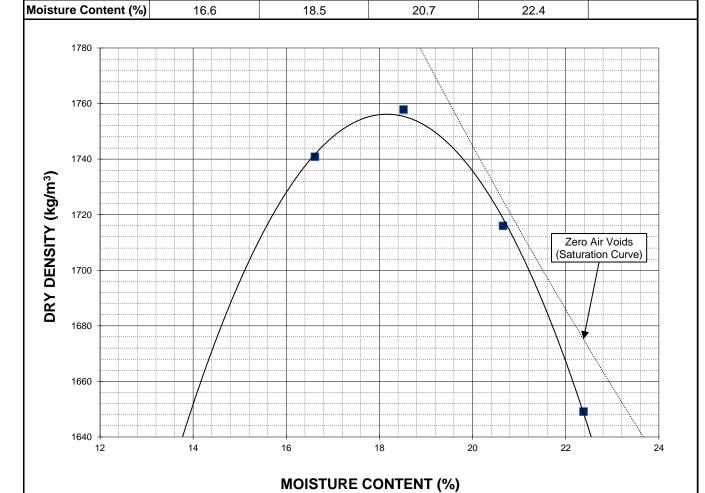
Test Date	10-1 60-22		Waxiiilaiii bi y beii	Sity (kg/iiis)	1730
Technician	RS		Optimum Moisture	e (%)	18.2
Trial Number	1	2	3	4	

2070

1716

2083

1758





California Bearing Ratio Test Data Sheet ASTM D1883-16

Project No. 1000-043-19 **Source** TH22-05,06

Client WSP Material Silt

Project2022 Local Streets PackageSample Date2022-02-07Sample #Bulk (Downing Street)Test Date2022-02-16

Technician RS

Proctor Results (ASTM D698) CBR Sample Compaction

Maximum Dry Density 1756 kg/m3 Dry Density 1662 kg/m3
Optimum Moisture Content 18.2 % Initial Moisture Content 20.1 %

Material Retained on 19 mm Sieve 0.0 % Relative Density 94.7 % SPMDD

Soaking Results CBR Results

 Surcharge
 4.54 kg
 CBR at 2.54 mm
 3.5 %

 Swell
 0.3 %
 CBR at 5.08 mm
 2.9 %

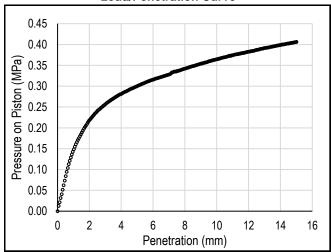
 Moisture Content in top 25 mm
 25.0 %
 Zero Correction
 0 mm

Immersion Period 96 h

Test Data

Measured Corrected Penetration (mm) Pressure (MPa) Pressure (MPa) 0.10 0.10 0.64 0.17 1.27 0.17 0.21 0.21 1.91 2.54 0.24 0.24 0.26 0.26 3.18 0.28 3.81 0.28 4.45 0.29 0.29 5.08 0.30 0.30 7.62 0.34 0.34 0.37 0.37 10.16 12.70 0.39 0.39

Load/Penetration Curve



Comments:





Photo 1: Pavement Core Sample at Test Hole TH22-04



Photo 02: Pavement Core Sample at Test Hole TH22-05

Project No. 1000 043 19 February 2022





Photo 3: Pavement Core Sample at Test Hole TH22-06



Appendix C

Test Hole Logs, Summary Table & Lab Testing Results and Pavement Core Photos – Palmerston Avenue



EXPLANATION OF FIELD AND LABORATORY TESTING

GENERAL NOTES

- 1. Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- 2. Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- 3. When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Ма	ijor Divi	sions	USCS Classi- fication	Symbols	Typical Names		Laboratory Class	sification (Criteria		Si			
	action	gravel no fines)	GW	3.6	Well-graded gravels, gravel-sand mixtures, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ greater that	an 4; C _c = 1	$(D_{30})^2$ between 1 and 3		ASTM Sieve sizes	#10 to #4	#40 to #10 #200 to #40	< #200
200 sieve size)	Gravels than half of coarse fraction s larger than 4.75 mm)	Clean gravel (Little or no fines)	GP		Poorly-graded gravels, gravel-sand mixtures, little or no fines	urve, 200 sieve 1bols*	Not meeting all grada	ition require	ments for GW	a	STM Si	#10	#40 t #200	* *
	Gray than half o larger tha	Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	rain size c rthan No. g dual sym	Atterberg limits below line or P.I. less than 4		Above "A" line with P.I. between 4 and 7 are border-	Particle Size	٩			+
ained soils larger thar	(More t	Gravel w (Appre amount	GC		Clayey gravels, gravel-sand-silt mixtures	vel from g on smaller llows: W, SP SM, SC s requiring	Atterberg limits above line or P.I. greater tha	e "A" ın 7	line cases requiring use of dual symbols	Part		5	00 25	
(More than half the material is larger than No. Sands s than half of coarse fraction is smaller than 4.75 mm) with fines (clean sands (Appreciable to fines)		SW	****	Well-graded sands, gravelly sands, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP More than 12 percent GM, GC, SM, SC 6 to 12 percent Borderline case4s requiring dual symbols*	$C_U = \frac{D_{60}}{D_{10}}$ greater that	an 6; C _c = 1	$(D_{30})^2$ between 1 and 3		mm	2.00 to 4.75	0.425 to 2.00 0.075 to 0.425	< 0.075	
		Clean (Little or I	SP		Poorly-graded sands, gravelly sands, little or no fines	ages of sar entage of f s are class cent G rrcent	Not meeting all grada	ition require	ments for SW			.,	o o	
(More than	Sar than half o smaller tha	Sands with fines (Appreciable amount of fines)	SM	333	Silty sands, sand-silt mixtures	e percenta g on perce rained soil than 5 perc than 12 percent	Atterberg limits below line or P.I. less than 4		Above "A" line with P.I. between 4 and 7 are border-	<u>.</u>	5			Clay
	(More than is sm? Sands with (Apprecia		SC		Clayey sands, sand-clay mixtures	Determin dependin coarse-g Less t More	Atterberg limits above line or P.I. greater tha	line cases requiring use of dual symbols	Material		Sand Coarse	Medium Fine	Silt or Clay	
size)	s/s	. (ML		Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity	80 Plasticity	Plasticit		t runte		Sizes	Ë	i.	Ë
Fine-Grained soils material is smaller than No. 200 sieve	Silts and Clays	ss than 50	CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	70 – smaller th	an 0.425 mm		"I THE	e)	ASTM Sieve Sizes	> 12 in. 3 in. to 12 in.	3/4 in. to 3 in.	#4 to 3/4 in.
soils er than No.	Sis	~ <u>o</u>	OL		Organic silts and organic silty clays of low plasticity	NDEX (%)	1	/ cth		Particle Size	AST	+		-
-Grained a	s,	50)	МН		Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts	PLASTICITY INDEX				Par	mm	> 300 75 to 300	77	4.75 to 19
Fine- the material	Silts and Clays	ater than 6	СН		Inorganic clays of high plasticity, fat clays	20 -	6		MH OR OH		Ε,	> (75 tc	6	4.75
(More than half the			ОН		Organic clays of medium to high plasticity, organic silts	7 4 0 10	ML or OL 16 20 30 40 50 LIQUIE	60 70 D LIMIT (%)	0 80 90 100 110	<u></u>	5	ers es		
(More	Highly	Soils	Pt	6 70 70 50 50 7	Peat and other highly organic soils	Von Post Class	sification Limit		olour or odour, Infibrous texture	Material		Boulders Cobbles	Gravel Coarse	Fine

^{*} Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.

Other Symbol Types

Asphalt	Bedrock (undifferentiated)	Cobbles
Concrete	Limestone Bedrock	Boulders and Cobbles
Fill	Cemented Shale	Silt Till
	Non-Cemented Shale	Clay Till



EXPLANATION OF FIELD AND LABORATORY TESTING

LEGEND OF ABBREVIATIONS AND SYMBOLS

PL - Plastic Limit (%)
PI - Plasticity Index (%)

▼ Water Level at End of Drilling

MC - Moisture Content (%)

Water Level After Drilling as Indicated on Test Hole Logs

SPT - Standard Penetration Test Indicated on Test Hole Logs
RQD - Rock Quality Designation

Su - Undrained Shear Strength VW - Vibrating Wire Piezometer

Qu - Unconfined Compression

SI - Slope Inclinometer

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE
and	and CLAY	35 to 50 percent
"y" or "ey"	clayey, silty	20 to 35 percent
some	some silt	10 to 20 percent
trace	trace gravel	1 to 10 percent

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Verv dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

Descriptive Terms	<u>SPT (N) (Blows/300 mm)</u>						
Very soft	< 2						
Soft	2 to 4						
Firm	4 to 8						
Stiff	8 to 15						
Very stiff	15 to 30						
Hard	> 30						

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Undrained Shear <u>Strength (kPa)</u>
< 12
12 to 25
25 to 50
50 to 100
100 to 200
> 200





Client: WSP Canad	a Inc		Project Number:								
Project Name: Local Street	Package 22-R-05		Location: UTM N-5526586, E-631325 (Palmerston Avenue)								
Contractor: Maple Leaf I	Drilling		Ground Elevation:	: Top of Pave	ement						
Method: 125mm Solid S	tem Auger, B40 Mobile Truck Mount		Date Drilled:	February 8,	2022						
Sample Type:	Grab (G)	Shelby Tube (T)	Split Spoon (S	SS) / SPT	Split Barre	el (SB) / LPT	C	ore (C)			
Particle Size Legend:	Fines Clay	Silt	Sand	Grav	vel 🔀 (Cobbles	Bould	lers			
Depth (m) Soil Symbol	MATERIAL DES	SCRIPTION		Sam	PL MC	9 20 21	Undraine Strengtl Test △ Torv Pocke □ Q ○ Field 50 100	n (kPa) <u>Type</u> ane ∆ t Pen. ∳ u ⊠			
ASPHALT - 30 CONCRETE - 2	210 mm thick			PC22-26	3						
CLAY - silty, train - brown - frozen to - high plast - AASHTO:	1.8 m depth, moist and stiff to ve	ery stiff when thaw	ed	G43	•						
				G44	•						
1.0				G45	•						
-1.5-				G46				_			
				G47 G48				○			
-2.0-				G49	•			ΔΦ			
1) No seepage of 2) Test hole ope 3) Test hole bac 4) Test hole loca South curb.	HOLE AT 2.3 m IN CLAY or sloughing observed. en to 2.3 m immediately after drickfilled with auger cuttings, grantated in front of #954 Palmerston uple was collected between 0.3 r	ular fill and cold pa ave, Eastbound la	ane, 1.5 m North of								
Logged By: Asad Dustmar	matov Review	ed By: Angela Fi	dler-Kliewer	Projec	t Engineer:	Velson Ferrei	ra				

Test Hole TH22-08

1 of 1



Cli	ent: WSP Canada Inc					Project Number:	_1000-043-19							
Pr	oject Namo	e: Local Street	Package 22-R-05			Location:	UTM N-55265	90, E-631357 (Palmers	ston Avenue)					
Co	ntractor:	Maple Leaf	Drilling			Ground Elevation:	n: Top of Pavement							
Me	ethod:	125mm Solid S	tem Auger, B40 Mobile	Truck Mount		Date Drilled:	February 8, 2022							
	Sample	туре:	Grab (G)		Shelby Tube (T)	Split Spoon (S	SS) / SPT	Split Barrel (SB) / LPT	Core (C)					
	Particle	Size Legend:	Fines	Clay	Silt	Sand	Gravel	Cobbles	Boulders					
Depth	So	CONCRETE - 2		TERIAL DES	CRIPTION		Sample Type Sample Number	Bulk Unit Wt (KN/m³) 17 18 19 20 21 Particle Size (%) 20 40 60 80 100 PL MC LL 20 40 60 80 100 0	Undrained Shear Strength (kPa) Test Type △ Torvane △ Pocket Pen. ♣ ※ Qu ※ ○ Field Vane ○ 50 100 150 200 250					
222472	A A A A A A A A A A A A A A A A A A A	CLAY - silty, tra - grey - frozen to - high plas	ce sand	and firm to sti	ff when thawed		G50 G51							
PACKAGE 22-R-05_1000-043-19_A_AD.GPJ TREK.GDT 2/24/22	5-	- stiff to very stit					G53 G54 G55 G56		ΔΦ					
SUB-SURFACE LOG LOGS 2022-02-08_LOCAL STREET PACKAGE 22-R-05_	:	1) No seepage 2) Test hole ope 3) Test hole bac 4) Test hole loc North curb.	HOLE AT 2.3 m IN or sloughing observen to 2.3 m immediackfilled with auger cated in front of #94th ple was collected by	ved. ately after drill cuttings, granu 8 Palmerston	lar fill and cold pa ave, Westbound I	ane, 1.5 m South of								
SUB-S	gged By:	Asad Dustmar	matov	Reviewe	d By : Angela Fi	dler-Kliewer	_ Project E	ingineer: Nelson Ferre	eira					

Test Hole TH22-09

1 of 1



Client:		WSP Canada	a Inc				Project Number:	1000-043-	19			
Project	t Name:	Local Street I	Package :	22-R-05			Location:	UTM N-55	26587, E-6	31460 (Palmers	ton Avenue	e)
Contra	ctor:	Maple Leaf D	rilling				Ground Elevation:	Top of Pav	vement			
Method	d:	125mm Solid Ste	em Auger, E	340 Mobile Tru	ck Mount		Date Drilled:	February 8	3, 2022			
S	ample T	уре:	G	Grab (G)		Shelby Tube (T)	Split Spoon (S	S)/SPT	Split E	Barrel (SB) / LP	- 🔲 C	ore (C)
Р	article S	Size Legend:	F	ines	//// Clay	Silt	Sand	Gra	avel 🐬	Cobbles	Bould	lers
Depth (m)	Soil Symbol			MATE	RIAL DES	CRIPTION		Sample Type Sample Number	16 17 18 Partic 0 20 40	Alk Unit Wt (N/m³) B 19 20 21 — le Size (%) 0 60 80 100 MC LL 0 60 80 100	Undraine Strength Test ↑ △ Torv: Pocket ☑ Q: ○ Field \ 50 100	n (kPa) Type ane ∆ t Pen. Φ u ⊠
	AS	SPHALT - 10 n	nm thick									+
, a	4 9	ONCRETE - 2			os			PC22-2	28			
-0.5-		blackfrozen to 1high plastiAASHTO:	city	th, moist an	d firm to st	iff when thawed		G57	•			
								G58	•			
1.0	- b	orown, no orga	nics belov	w 0.9 m				G59			•	
100.								G 60	_		ΔΦ	
2 -1.5-								G61			ΔΦ	
X 81-51-51								G01				
2.0								G62	•		40	
PACINA								G63	•		∆©	
	1) 2) 3) 4) cu	Test hole loca irb.	r sloughir n to 2.3 m kfilled with ted in fro	ng observed n immediate h auger cutt nt of #920 F	d. ly after drill ings, granu Palmerston	ılar fill and cold pa	ane, 1.5 South of Nor	th				
Logged	d By: _ <i>A</i>	Asad Dustmam	atov		Reviewe	ed By: Angela		_ Proje	ct Enginee	r: Nelson Ferr	eira	



GEOTECHNICOL

Client: WSP Canad	la Inc		Project Number:								
Project Name: Local Street	Package 22-R-05		Location: UTM N-5526623, E-631519 (Palmerston Avenue)								
Contractor: Maple Leaf I	Drilling		Ground Elevation:	Top of Paven	nent						
Method: 125mm Solid S	Stem Auger, B40 Mobile Truck Mount		Date Drilled:	February 8, 2	022						
Sample Type:	Grab (G)	Shelby Tube (T)	Split Spoon (S	SS) / SPT	Split Barrel (SB) / LF	PT Core (C)					
Particle Size Legend:	Fines Clay	Silt	Sand	Grave	Cobbles	Boulders					
Depth (m) Soil Symbol	MATERIAL DES	CRIPTION		Sample Type Sample Number	Bulk Unit Wt (kN/m²) 17 18 19 20 21 Particle Size (%) 20 40 60 80 100 PL MC LL 20 40 60 80 100	Undrained Shear Strength (kPa) Test Type △Torvane △ Procket Pen. ♣ ※ Qu ※ ○ Field Vane ○ 0 50 100 150 200250					
ASPHALT - 30 CONCRETE - 1	80 mm thick			PC22-29							
CLAY - silty, tranduction - brown - frozen to - high plast - AASHTO:	1.8 m depth, moist and stiff to ve	ry stiff when thawed	i	G64	•						
				G65	•						
-1.0- 				G66		•					
-1.5-				G67 G68	•	ΔΦ					
- light brown bel	low 1.8 m			G69	•	ΔΦ					
2.0-				G70	•	ΔΦ					
1) No seepage of 2) Test hole ope 3) Test hole bac 4) Test hole loca South curb.	HOLE AT 2.3 m IN CLAY or sloughing observed. en to 2.3 m immediately after drill ckfilled with auger cuttings, granuated in front of #910 Palmerston nple was collected between 0.3 n	ılar fill and cold pato ave, Eastbound lan	ch asphalt. e, 1.5 m North of								
Logged By: Asad Dustmar	matov Review s	ed By: Angela Fidle	er-Kliewer	Project I	Engineer: Nelson Fe	rreira					





Clier	nt:	WSP Canad	da Inc				Project Number:	1000-043	3-19				
Proje	ect Name	e: Local Street	: Package 22-R-0)5			Location:	UTM N-5	52665	2, E-6315	57 (Palmer	ston Ave	enue)
Cont	tractor:	Maple Leaf	Drilling				Ground Elevation:	Top of Pa	aveme	nt			
Meth	nod:	125mm Solid S	Stem Auger, B40 Mob	ile Truck Mount			Date Drilled:	February	8, 202	22			
	Sample	Туре:	Grab (0	S)	Shelby	/ Tube (T)	Split Spoon (S	S)/SPT		Split Barre	el (SB) / LP	г 🔲	Core (C)
	Particle	Size Legend:	Fines	CI	ay [Silt	Sand	G	iravel		Cobbles	В	oulders
Depth (m)	So	ASPHALT - 40		MATERIAL C	DESCRIPT	ON		Sample Type	0 2	Particle Siz	9 20 21	Stre	ained Shear ength (kPa) est Type Forvane △ cket Pen. • ☑ Qu ⊠ eld Vane ○
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	CONCRETE - 1						PC22	2-30				
•		CLAY - silty_tra	ce sand, trace o	rganics					_				
-0.5-		 dark brov 	vn 1.8 m depth, mo ticitv	-	stiff when t	hawed		G7	'1 	•			
								G7	72	•			
-1.0-								G7	73	•			
REK.GDT 2/24/22								G7	74	•			
1000-043-19_A_AD.GPJ_TREK.GDT_2/24/22								G7	75	•			ΔΦ
		.						G7	' 6	•			△•
T PACKAGE 22-			anics below 2.0 ı					G7	77	•			△ •
SUB-SURFACE LOG LOGS 2022-02-08_LOCAL STREET PACKAGE 22-R-05_	; ;	1) No seepage 2) Test hole ope 3) Test hole bac 4) Test hole loc North curb.	HOLE AT 2.3 m or sloughing obs en to 2.3 m imme ckfilled with auge ated in front of # nple was collecte	erved. ediately after er cuttings, gi 897 Palmers	ranular fill a ston ave, W	estbound l	ane, 1.5 m South of						
SUB-SURF,	ged By:	Asad Dustmar	matov	Revi	ewed By:	Angela Fi	dler-Kliewer	_ Proj	ject En	gineer: _	Nelson Feri	eira	



GENTECHNICOL

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Bould Undraine Strengt Particle Size (KN/m³) 20 21 Undraine Strengt Particle Size (%) Particle Size (%) Particle Size (%) 0 20 40 60 80 100 PL MC LL OF Field	on Ferreira	ject Engineer: Nelson Ferre	er F	Reviewed By: Angela Fidler-	matov R	Asad Dustmama	ed By: _	Logg
Contractor: Maple Leaf Drilling			North of	ed. tely after drilling. uttings, granular fill and cold patch a Palmerston ave, Eastbound lane,	or sloughing observed. en to 2.3 m immediately a ckfilled with auger cuttings ated in front of #890 Palm	1) No seepage or 2) Test hole open 3) Test hole backf 4) Test hole locate South curb.	1) 2) 3) 4) So	2017 70-2 2027 02-00 100 100 100 100 100 100 100 100 100
Contractor: Maple Leaf Drilling								
Contractor: Maple Leaf Drilling 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: February 8, 2022 Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT Cobbles Solution: Strength Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT Cobbles Solution: Strength Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT Cobbles Solution: Strength Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT Cobbles Solution: Split Spoon (SS) / SPT Split Barrel (SB) / LPT Cobbles Solution: Split Spoon (SS) / SPT Split Barrel (SB) / LPT Cobbles Spoul Split Spoon (SS) / SPT Split Barrel (SB) / LPT Cobbles Spoul Split Spoon (SS) / SPT Split Barrel (SB) / LPT Cobbles Spoul Split Spoon (SS) / SPT Split Spoon (SS) / Split Split Split Split Split Split	200				anics below 1.4 m	- brown, no organi		2-1.5-
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: February 8, 2022 Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT Cobbles Particle Size Legend: Fines Clay Silt Silt Sand Grave Gra		<u></u>						100
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: February 8, 2022		00						-1.0-
Maple Leaf Drilling 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: February 8, 2022		9			: A-7-6 (I)	- AASHTO: A		-0.5-
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: February 8, 2022 Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT C Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Bould Strength Bulk Unit Wt (kN/m²) 16 17 18 19 20 21 Particle Size (%) Particle Size (%) Particle Size (%) Procket Cobbles Cobbles Cobbles Cobbles Cobbles Cobbles Clay Strength Clay Test Clay Test Clay Cla		8			vn 1.8 m depth, moist and st ticity	dark brownfrozen to 1.8high plastici	C	
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: February 8, 2022 Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT C Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Bould Bould Bulk Unit Wt Undraine Strengt Particle Size (%) Test ATON Particle Size (%)	30 100 0 30 100 100 100 100 100 100 100							
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: February 8, 2022 Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT C Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Bould	20 21 Strength (kPa) Test Type	PL MC LL	Sample Type	TERIAL DESCRIPTION	MATERIA		Soil Symbol	Depth (m)
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: February 8, 2022							-	
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement	B) / LPT Core (C)							Meth
Project Name: Local Street Package 22-K-U5 Location: UTM N-5526684, E-631619 (Palmerston Avenue)								
Client: WSP Canada inc Project Number: 1000-043-19	^D almerston Avenue)							

TREK

2022 Local Street Package - 22-R-05 Sub-Surface Investigation

Palmerston Avenue - between Ethelbert Street and Arlington Street

Test Hole		Paveme	ent Surface	Pavement Str	ucture Material		Sample	Depth (m)	Moisture		Grain Siz	e Analysis	8	Atterberg Limits		
No.	Test Hole Location	Туре	Thickness (mm)	Type	Thickness (mm)	Subgrade Description	Top (m)	Bottom (m)	Content (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
		Asphalt	30	Concrete	210	Clay; AASHTO: A-7-6 (I)	0.3	0.5	25							
	UTM : 14U 5526586 N,					Clay; AASHTO: A-7-6 (I)	0.6	0.8	23							
	631325 E					Clay; AASHTO: A-7-6 (I)	0.9	1.1	23							
TH22-07	Located in front of #954 Pamerston Ave,					Clay; AASHTO: A-7-6 (I)	1.2	1.4	25							
	Eastbound lane, 1.5 m					Clay; AASHTO: A-7-6 (I)	1.5	1.7	24							
	North of South curb.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	28							
						Clay; AASHTO: A-7-6 (I)	2.1	2.3	23							
		Asphalt	-	Concrete	230	Clay; AASHTO: A-7-6 (39)	0.3	0.5	32							
	UTM : 14U 5526590 N,					Clay; AASHTO: A-7-6 (39)	0.6	0.8	29							
	631357 E					Clay; AASHTO: A-7-6 (39)	0.9	1.1	31	41	56	3	0	20	56	36
TH22-08	Located in front of #948 Pamerston Ave,					Clay; AASHTO: A-7-6 (39)	1.2	1.4	31							
	Westbound lane, 1.5 m South of North curb.					Clay; AASHTO: A-7-6 (39)	1.5	1.7	30							
	South of North Curb.					Clay; AASHTO: A-7-6 (39)	1.8	2.0	25							
						Clay; AASHTO: A-7-6 (39)	2.1	2.3	36							
		Asphalt	90	Concrete	210	Clay; AASHTO: A-7-6 (I)	0.3	0.5	35							
	UTM : 14U 5526587 N,					Clay; AASHTO: A-7-6 (I)	0.6	0.8	30							
	631460 E					Clay; AASHTO: A-7-6 (I)	0.9	1.1	28							
TH22-09	Located in front of #920 Pamerston Ave,					Clay; AASHTO: A-7-6 (I)	1.2	1.4	27							
	Westbound lane, 1.5 m South of North curb.					Clay; AASHTO: A-7-6 (I)	1.5	1.7	28							
İ	South of North Curb.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	27							
						Clay; AASHTO: A-7-6 (I)	2.1	2.3	27							<u> </u>
		Asphalt	30	Concrete	180	Clay; AASHTO: A-7-6 (I)	0.3	0.5	28							
	UTM : 14U 5526623 N,					Clay; AASHTO: A-7-6 (I)	0.6	0.8	28							
	631519 E					Clay; AASHTO: A-7-6 (I)	0.9	1.1	26							
TH22-10	Located in front of #910 Pamerston Ave,					Clay; AASHTO: A-7-6 (I)	1.2	1.4	28							<u> </u>
	Eastbound lane, 1.5 m North of South curb.					Clay; AASHTO: A-7-6 (I)	1.5	1.7	23							<u> </u>
	Horar of Codar carb.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	23							
l						Clay; AASHTO: A-7-6 (I)	2.1	2.3	24							

⁽I) - AASHTO classification was interpreted based on visual classification.



2022 Local Street Package - 22-R-05 Sub-Surface Investigation

Palmerston Avenue - between Ethelbert Street and Arlington Street

Test Hole	T	Paveme	ent Surface	Pavement Str	ucture Material		Sample	Depth (m)	Moisture		Grain Siz	e Analysis	3	Atterberg Limits		imits
No.	Test Hole Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Subgrade Description	Top (m)	Bottom (m)	Content (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
		Asphalt	40	Concrete	130	Clay; AASHTO: A-7-6 (I)	0.3	0.5	29							
	UTM : 14U 5526652 N,					Clay; AASHTO: A-7-6 (I)	0.6	0.8	28							
	631557 E Located in front of #897					Clay; AASHTO: A-7-6 (I)	0.9	1.1	28							
TH22-11	Pamerston Ave,					Clay; AASHTO: A-7-6 (I)	1.2	1.4	26							
	Westbound lane, 1.5 m					Clay; AASHTO: A-7-6 (I)	1.5	1.7	28							
	South of North curb.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	30							
						Clay; AASHTO: A-7-6 (I)	2.1	2.3	27							
		Asphalt	90	Concrete	130	Clay; AASHTO: A-7-6 (I)	0.3	0.5	32							
	UTM : 14U 5526684 N,					Clay; AASHTO: A-7-6 (I)	0.6	0.8	31							
	631619 E					Clay; AASHTO: A-7-6 (I)	0.9	1.1	31							
TH22-12	Located in front of #890 Pamerston Ave,					Clay; AASHTO: A-7-6 (I)	1.2	1.4	32							
	Eastbound lane, 1.5 m					Clay; AASHTO: A-7-6 (I)	1.5	1.7	29							
	North of South curb.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	29							
						Clay; AASHTO: A-7-6 (I)	2.1	2.3	28							

⁽I) - AASHTO classification was interpreted based on visual classification.



Project Street Package 22-R-05- Palmerston Ave

Sample Date07-Feb-22Test Date09-Feb-22TechnicianAD

Test Hole	TH22-07	TH22-07	TH22-07	TH22-07	TH22-07	TH22-07
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0
Sample #	G43	G44	G45	G46	G47	G48
Tare ID	Z114	H13	F83	E42	F110	F99
Mass of tare	8.5	8.5	8.6	8.6	8.2	8.7
Mass wet + tare	174.7	183.6	181.6	258.0	254.7	233.4
Mass dry + tare	141.8	150.5	149.2	208.2	206.9	184.0
Mass water	32.9	33.1	32.4	49.8	47.8	49.4
Mass dry soil	133.3	142.0	140.6	199.6	198.7	175.3
Moisture %	24.7%	23.3%	23.0%	24.9%	24.1%	28.2%

Test Hole	TH22-07	TH22-08	TH22-08	TH22-08	TH22-08	TH22-08
Depth (m)	2.1 - 2.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7
Sample #	G49	G50	G51	G52	G53	G54
Tare ID	F79	H60	P11	Z105	H69	W65
Mass of tare	8.8	8.8	8.5	8.4	9.5	8.4
Mass wet + tare	278.8	252.8	185.9	408.8	208.5	216.3
Mass dry + tare	228.0	193.4	146.1	314.7	161.7	168.0
Mass water	50.8	59.4	39.8	94.1	46.8	48.3
Mass dry soil	219.2	184.6	137.6	306.3	152.2	159.6
Moisture %	23.2%	32.2%	28.9%	30.7%	30.7%	30.3%

Test Hole	TH22-08	TH22-08	TH22-09	TH22-09	TH22-09	TH22-09
Depth (m)	1.8 - 2.0	2.1 - 2.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4
Sample #	G55	G56	G57	G58	G59	G60
Tare ID	E2	Z14	Z120	AB50	Z52	Z41
Mass of tare	8.6	8.6	8.9	6.8	8.6	8.5
Mass wet + tare	203.0	216.6	263.8	229.4	206.4	195.9
Mass dry + tare	164.1	161.5	198.1	177.7	163.2	156.6
Mass water	38.9	55.1	65.7	51.7	43.2	39.3
Mass dry soil	155.5	152.9	189.2	170.9	154.6	148.1
Moisture %	25.0%	36.0%	34.7%	30.3%	27.9%	26.5%



Project Street Package 22-R-05- Palmerston Ave

Sample Date07-Feb-22Test Date09-Feb-22TechnicianAD

Test Hole	TH22-09	TH22-09	TH22-09	TH22-10	TH22-10	TH22-10
Depth (m)	1.5 - 1.7	1.8 - 2.0	2.1 - 2.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1
Sample #	G61	G62	G63	G64	G65	G66
Tare ID	F133	P10	F153	W07	Z51	N52
Mass of tare	8.4	8.4	8.4	8.6	8.5	8.7
Mass wet + tare	243.8	207.7	226.3	169.4	191.4	240.4
Mass dry + tare	192.4	165.8	180.0	133.9	151.7	193.1
Mass water	51.4	41.9	46.3	35.5	39.7	47.3
Mass dry soil	184.0	157.4	171.6	125.3	143.2	184.4
Moisture %	27.9%	26.6%	27.0%	28.3%	27.7%	25.7%

Test Hole	TH22-10	TH22-10	TH22-10	TH22-10	TH22-11	TH22-11
Depth (m)	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0	2.1 - 2.3	0.3 - 0.5	0.6 - 0.8
Sample #	G67	G68	G69	G70	G71	G72
Tare ID	A3	AB13	N01	AC27	AB12	C28
Mass of tare	8.4	6.7	8.4	7.0	7.1	8.3
Mass wet + tare	185.7	215.7	224.6	242.6	261.3	211.5
Mass dry + tare	147.4	176.1	184.2	197.3	204.4	167.2
Mass water	38.3	39.6	40.4	45.3	56.9	44.3
Mass dry soil	139.0	169.4	175.8	190.3	197.3	158.9
Moisture %	27.6%	23.4%	23.0%	23.8%	28.8%	27.9%

Test Hole	TH22-11	TH22-11	TH22-11	TH22-11	TH22-11	TH22-12
Depth (m)	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0	2.1 - 2.3	0.3 - 0.5
Sample #	G73	G74	G75	G76	G77	G78
Tare ID	C8	F141	F60	H03	F17	W30
Mass of tare	8.4	8.7	8.6	8.5	8.3	8.4
Mass wet + tare	168.5	161.4	280.2	248.9	223.8	181.3
Mass dry + tare	133.7	130.2	220.1	193.1	178.3	139.7
Mass water	34.8	31.2	60.1	55.8	45.5	41.6
Mass dry soil	125.3	121.5	211.5	184.6	170.0	131.3
Moisture %	27.8%	25.7%	28.4%	30.2%	26.8%	31.7%

Project Street Package 22-R-05- Palmerston Ave

31.4%

Sample Date07-Feb-22Test Date09-Feb-22TechnicianAD

Moisture %

Test Hole	TH22-12	TH22-12	TH22-12	TH22-12	TH22-12	TH22-12
Depth (m)	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0	2.1 - 2.3
Sample #	G79	G80	G81	G82	G83	G84
Tare ID	W04	N04	A17	W92	AB05	W90
Mass of tare	8.4	8.6	8.5	8.4	6.6	8.4
Mass wet + tare	242.5	224.2	196.4	218.4	215.9	235.7
Mass dry + tare	186.5	172.9	150.6	171.3	168.4	185.8
Mass water	56.0	51.3	45.8	47.1	47.5	49.9
Mass dry soil	178.1	164.3	142.1	162.9	161.8	177.4

32.2%

28.9%

29.4%

28.1%

31.2%



www.trekgeotechnical.ca 1712 St. James Street Winnipeg, MB R3H 0L3

Tel: 204.975.9433 Fax: 204.975.9435

Atterberg Limits ASTM D4318-10e1

 Project No.
 1000-043-19

 Client
 WSP Canada Inc

Project Local Street Package 22-R-05-Palmerston Ave

 Depth (m)
 0.9 - 1.1

 Sample Date
 07-Feb-22

 Test Date
 14-Feb-22

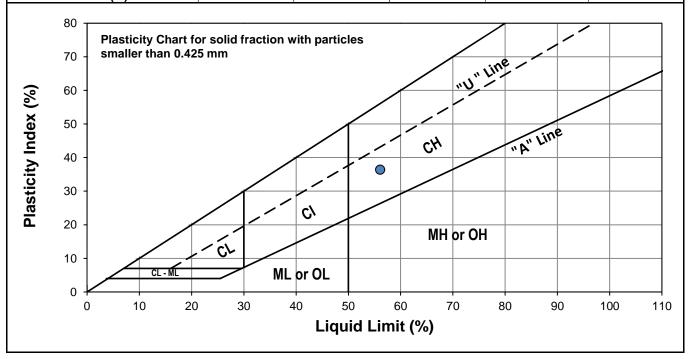
 Technician
 NM



Liquid Limit 56
Plastic Limit 20
Plasticity Index 36

Liquid Limit

Trial #	1	2	3	
Number of Blows (N)	16	26	35	
Mass Tare (g)	14.315	14.235	13.970	
Mass Wet Soil + Tare (g)	26.264	24.978	25.784	
Mass Dry Soil + Tare (g)	21.853	21.120	21.638	
Mass Water (g)	4.411	3.858	4.146	
Mass Dry Soil (g)	7.538	6.885	7.668	
Moisture Content (%)	58.517	56.035	54.069	



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.157	14.101			
Mass Wet Soil + Tare (g)	24.606	24.763			
Mass Dry Soil + Tare (g)	22.890	23.005			
Mass Water (g)	1.716	1.758			
Mass Dry Soil (g)	8.733	8.904			
Moisture Content (%)	19.650	19.744			



Project Local Street Package 22-R-05-Palmerston Ave

 Test Hole
 TH22-08

 Sample #
 G52

 Depth (m)
 0.9 - 1.1

 Sample Date
 7-Feb-22

 Test Date
 11-Feb-22

 Technician
 NM



Gravel	0.0%
Sand	3.3%
Silt	56.0%
Clay	40.7%

Particle Size Distribution Curve Sand Gravel Silt Clay Fine Coarse Medium Fine 100 90 80 Percent Finer by Weight 70 60 50 40 30 20 10 0 0.001 0.01 0.1 10 100 Particle Size (mm)

Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	96.73
37.5	100.00	2.00	100.00	0.0531	92.83
25.0	100.00	0.850	99.97	0.0388	85.64
19.0	100.00	0.425	99.93	0.0282	80.01
12.5	100.00	0.180	99.86	0.0185	70.94
9.50	100.00	0.150	99.79	0.0148	67.57
4.75	100.00	0.075	96.73	0.0111	62.25
				0.0079	57.94
				0.0057	53.00
				0.0041	49.31
				0.0029	45.18
				0.0021	41.30
				0.0012	35.99



Project No. 1000-043-19

Client WSP

Project 2022 Local Streets Package

Sample # Combined bulk samples

RS

Source TH22-07, 08, 09 (Palmerston Ave.)

Material Clay

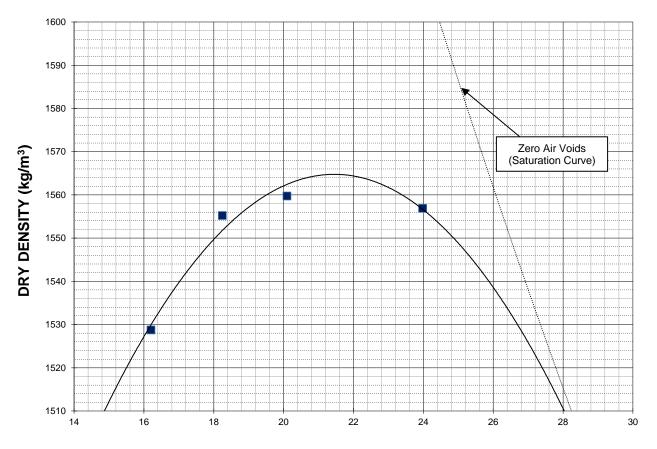
Technician

Sample Date07-Feb-22Test Date10-Feb-22



Maximum Dry Density (kg/m3)	1565
Optimum Moisture (%)	21.5

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1776	1839	1873	1930	
Dry Density (kg/m ³)	1529	1555	1560	1557	
Moisture Content (%)	16.2	18.2	20.1	24.0	



MOISTURE CONTENT (%)



California Bearing Ratio Test Data Sheet ASTM D1883-16

Project No. 1000-043-19 **Source** TH22-07, 08, 09

Client WSP Material Clay

Project2022 Local Streets PackageSample Date2022-02-07Sample #Bulk (Palmerston Ave)Test Date2022-02-16

Technician RS

Proctor Results (ASTM D698) CBR Sample Compaction

Maximum Dry Density 1565 kg/m3 Dry Density 1479 kg/m3
Optimum Moisture Content 21.5 % Initial Moisture Content 23.3 %

Material Retained on 19 mm Sieve 0.0 % Relative Density 94.5 % SPMDD

Soaking Results CBR Results

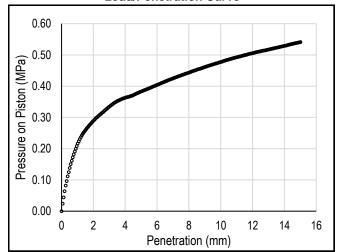
Surcharge 4.54 kg CBR at 2.54 mm 4.6 % Swell 0.7 % CBR at 5.08 mm 3.7 % Moisture Content in top 25 mm 29.7 % Zero Correction 0 mm

Immersion Period 96 h

Test Data

Measured Corrected Penetration (mm) Pressure (MPa) Pressure (MPa) 0.16 0.16 0.64 0.24 0.24 1.27 0.28 0.28 1.91 2.54 0.32 0.32 0.34 0.34 3.18 3.81 0.36 0.36 4.45 0.37 0.37 5.08 0.38 0.38 7.62 0.44 0.44 0.48 0.48 10.16 12.70 0.51 0.51

Load/Penetration Curve



Comments:



Project No. 1000-043-19

Client WSP

Project 2022 Local Street Package

Sample # Combined bulk samples

DS

Source TH22-10, 11, 12 (Palmerston Ave)

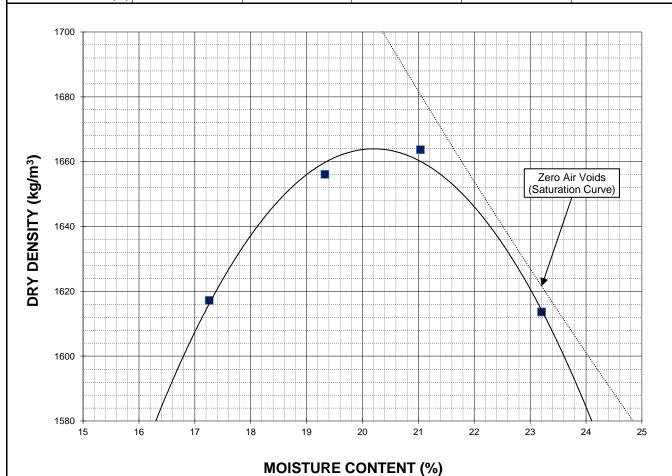
Material Clay

Technician

Sample Date07-Feb-22Test Date09-Feb-22

Maximum Dry Density (kg/m3)1664Optimum Moisture (%)20.2

Trial Number	1	2	3	4	
Wet Density (kg/m³)	1896	1976	2014	1988	
Dry Density (kg/m ³)	1617	1656	1664	1614	
Moisture Content (%)	17.3	19.3	21.0	23.2	





California Bearing Ratio Test Data Sheet ASTM D1883-16

Project No. 1000-043-19 **Source** TH22-10, 11, 12

Client WSP Material Clay

Project2022 Local Streets PackageSample Date2022-02-07Sample #Bulk (Palmerston Ave.)Test Date2022-02-11

Technician DS

Proctor Results (ASTM D698) CBR Sample Compaction

Maximum Dry Density 1664 kg/m3 Dry Density 1575 kg/m3
Optimum Moisture Content 20.2 % Initial Moisture Content 21.5 %

Material Retained on 19 mm Sieve 0.0 % Relative Density 94.7 % SPMDD

Soaking Results CBR Results

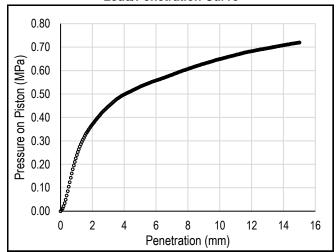
Surcharge 4.54 kg CBR at 2.54 mm 6.0 % Swell 0.7 % CBR at 5.08 mm 5.2 % Moisture Content in top 25 mm 26.2 % Zero Correction 0 mm

Immersion Period 96 h

Test Data

Measured Corrected Penetration (mm) Pressure (MPa) Pressure (MPa) 0.14 0.14 0.64 0.29 0.29 1.27 0.36 0.36 1.91 2.54 0.42 0.42 0.46 0.46 3.18 3.81 0.49 0.49 4.45 0.51 0.51 5.08 0.53 0.53 7.62 0.60 0.60 0.65 0.65 10.16 12.70 0.69 0.69

Load/Penetration Curve



Comments:





Photo 1: Pavement Core Sample at Test Hole TH22-07



Photo 2: Pavement Core Sample at Test Hole TH22-08

Project No. 1000 043 19 February 2022





Photo 3: Pavement Core Sample at Test Hole TH22-09



Photo 4: Pavement Core Sample at Test Hole TH22-10





Photo 5: Pavement Core Sample at Test Hole TH22-11

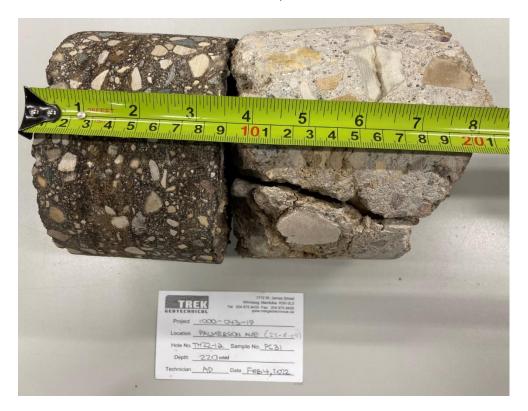


Photo 6: Pavement Core Sample at Test Hole TH22-12



Δ	n	n	e	n	d	ix	D
_	v	~	·		u	IA	\boldsymbol{L}

Test Hole Logs, Summary Table & Lab Testing Results and Pavement Core Photos – Sargent Ave/Spruce St Alley



EXPLANATION OF FIELD AND LABORATORY TESTING

GENERAL NOTES

- 1. Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- 2. Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- 3. When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Ma	jor Div	isions	USCS Classi- fication	Symbols	Typical Names		Laboratory Classific	cation Criteria		ς,			
	action	gravel no fines)	GW	36	Well-graded gravels, gravel-sand mixtures, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ greater than 4	4; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3		ASTM Sieve sizes	#10 to #4	#40 to #10	< #200
sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	Clean gravel (Little or no fines)	GP	.A.	Poorly-graded gravels, gravel-sand mixtures, little or no fines	urve, 200 sievej nbols*	Not meeting all gradation	requirements for GW	0	STMS	#10	#40 t	* V
No. 200 s	Gray than half o	Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	rain size c r than No. g dual sym	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are border-	Particle Size	⋖			
ained soils larger thar	(More	Gravel w (Appre amount	GC		Clayey gravels, gravel-sand-silt mixtures	vel from g on smaller llows: W, SP SM, SC SM, SC	Atterberg limits above "A" line or P.I. greater than 7	line cases requiring use of dual symbols	Part		22	00 ۾د	9
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	action	sands no fines)	SW	****	Well-graded sands, gravelly sands, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP More than 12 percent GM, GC, SM, SC 6 to 12 percent Borderline case4s requiring dual symbols*	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6	$C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3		E	2.00 to 4.75	0.425 to 2.00	< 0.075
half the r	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (Little or no fines)	SP		Poorly-graded sands, gravelly sands, little or no fines	ages of sarentage of farentage of farentage of farentage of farentage.	Not meeting all gradation	requirements for SW			•	0 0	<i>i</i>
(More than	Sar than half c	Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures	ne percentarion percentarion percentarion percentarion percentarion percentarion percentarion 12 percentarion	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are border-	rial				Clay
	(More	Sands w (Appre amount	SC		Clayey sands, sand-clay mixtures	Determin dependin coarse-g Less t More	Atterberg limits above "A" line or P.I. greater than 7	line cases requiring use of dual symbols	Material	0000	Coarse	Medium	Silt or Clay
size)	ys.		ML		Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity	80 Plasticity	Plasticity (Chart	i	Sizes	. <u>.</u> . <u>.</u> :	2	i ii
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silts and Clar	(Liquid limit less than 50)	CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	70 – 60 –	an 0.425 mm	"I III" I III	9	ASTM Sieve Sizes	3 in. to 12 in.	3/4 in 40 3 in	3/4 III. (0 3 III #4 to 3/4 in.
soils er than No	is.	<u> </u>	OL		Organic silts and organic silty clays of low plasticity	NDEX (%)		CA CA	Particle Size	AS			_
e-Grained al is small	iys	t 50)	MH	Ш	Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts	PLASTICITY INDEX				mm *300	75 to 300	 	19 to 75 4.75 to 19
Fine the materi.	ts and Cla	(Liquid limit greater than 50)	СН		Inorganic clays of high plasticity, fat clays	20 -	0	MH OR OH		<u>-</u>	75 to		4.75
than half	<u> </u>		ОН		Organic clays of medium to high plasticity, organic silts	7 4 0 10	ML or OL 16 20 30 40 50 LIQUID LIM	60 70 80 90 100 110 IIT (%)	rial	9	S S		
(More	Highly	Organic Soils	Pt	6 46 46 47 47 4	Peat and other highly organic soils	Von Post Class		rong colour or odour, nd often fibrous texture	Material	Double	Cobbles	Gravel	Fine

^{*} Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.

Other Symbol Types

Asphalt	Bedrock (undifferentiated)	Cobbles
Concrete	Limestone Bedrock	Boulders and Cobbles
Fill	Cemented Shale	Silt Till
	Non-Cemented Shale	Clay Till



EXPLANATION OF FIELD AND LABORATORY TESTING

LEGEND OF ABBREVIATIONS AND SYMBOLS

PL - Plastic Limit (%)
PI - Plasticity Index (%)

▼ Water Level at End of Drilling

MC - Moisture Content (%)

Water Level After Drilling as Indicated on Test Hole Logs

SPT - Standard Penetration Test Indicated on Test Hole Logs
RQD - Rock Quality Designation

Su - Undrained Shear Strength VW - Vibrating Wire Piezometer

Qu - Unconfined Compression

SI - Slope Inclinometer

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE
and	and CLAY	35 to 50 percent
"y" or "ey"	clayey, silty	20 to 35 percent
some	some silt	10 to 20 percent
trace	trace gravel	1 to 10 percent

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Verv dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

Descriptive Terms	<u>SPT (N) (Blows/300 mm)</u>
Very soft	< 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very stiff	15 to 30
Hard	> 30

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Undrained Shear <u>Strength (kPa)</u>
< 12
12 to 25
25 to 50
50 to 100
100 to 200
> 200





Client:	WSP Canad	a Inc			Project Number:										
Project Nam	e: Local Street	Package 22-R-05			Location:	UTM	N-5528	8596, E-6	630285	(Spruce	St/Clifto	n St A	lley)_		
Contractor:	Maple Leaf [Drilling			Ground Elevation	: <u>Top o</u>	f Pave	ment							
Method:	125mm Solid St	em Auger, B40 Mobile T	ruck Mount		Date Drilled:	Febru	ıary 8,	2022							
Sample	е Туре:	Grab (G)		Shelby Tube (T)	Split Spoon (SS) / SF	т	Split	Barrel ((SB) / LP	Т	Core	(C)		
Particle	e Size Legend:	Fines	Clay	Silt	Sand		Grav	el 5	<u>~</u> c₀	bbles	В	oulder	S		
Depth (m) Soil Symbol		МАТ		Sample Type	Sample Number	Partio	ulk Unit \(\text{KN/m}^3 \) \(\text{KN/m}^3 \) \(\text{IS} \) \(\text{IS} \) \(\text{Cle Size} \) \(\text{IS} \) \(\text{MC} \) \(\text{MC} \) \(\text{IS} \) \(\tex	20 21	Stre	ained S ength (k est Typ Forvane ocket Pe ⊠ Qu ⊠ eld Var 00 15	<u>Pa)</u> <u>e</u> e ∆ en. ∳				
	CLAY - silty, trac - grey - frozen to - high plast - AASHTO:	ce sand 1.5 m depth, moist a	and stiff to ve	ry stiff when thaw	<i>r</i> ed		PC22-32	•							
							G86	•							
-1.0-							G87 G88	•			40				
-1.5-						4	G89	•			△ 4	•			
-2.0-							G90	•	•		40				
		HOLE AT 2.3 m IN (G91		•		△•				
	 Test hole ope Test hole bac Test hole loca alley. 	or sloughing observen to 2.3 m immedia skfilled with auger cuated in back alley of aple was collected be	tely after drill ittings, granu house #992	lar fill and cold pa Clifton street, 1 n	n North of South edg	e of									
Logged By:	Asad Dustman	natov	Reviewe	d By: Angela F	idler-Kliewer	F	Project	Enginee	er: Ne	elson Fer	reira				





Client:	WSP Canada	a Inc			Project Number:	1000-	-043-1	19						
Project Nam	e: Local Street F	Package 22-R-05			Location:	UTM	N-552	28546,	E-630	243 (5	Spruce	St/Cliftc	n St A	lley)_
Contractor:	Maple Leaf D	Drilling			Ground Elevation	: <u>Top o</u>	f Pav	ement						
Method:	125mm Solid Ste	em Auger, B40 Mobile	Truck Mount		Date Drilled:	Febru	ary 8	, 2022						
Sample	е Туре:	Grab (G)		Shelby Tube (T)	(SS) / SPT Split Barrel (SB) / LPT Core (C)									
Particle	e Size Legend:	Fines	Sand		Gra	vel	57	Cobb	oles	В	S			
Depth (m) Soil Symbol		MA		Sample Type	amp	16 17		n ³) 19 2 ize (%) 60 8	20 21 —	Stre	rained S ength (k est Typ Torvane ocket Pe ⊠ Qu ⊠ ield Var	:Pa) ee e ∆ en. Ф		
	- black	- some sand, trace	•				C22-33	3						
-0.5-	- intermedia - AASHTO:	ate plasticity	шамси				G93		•					
-1.0							G94				* * * * * * * * * * * * * * * * * * *			
-1.5-	SILT - some sar - light browr	1					G95	•	•					
		I.5 m depth, moist rmediate plasticity A-4 (I)		n thawed			G96	•						
-2.0-	- brown - moist, stiff - high plasti - AASHTO:	city				4	G97		•			•		
							G98		•			Δ Φ		
1	 No seepage o Test hole oper Test hole back Test hole located of alley. 	HOLE AT 2.3 m IN or sloughing obser n to 2.3 m immed kfilled with auger ted in back alley or ple was collected	ved. ately after dril cuttings, granu of house #106	ular fill and cold pa 5 Spruce street, 1	.5 m West of East ed	dge								
Logged By:	Asad Dustmam	natov	Reviewe	ed By: _Angela F	idler-Kliewer	F	Projec	t Engi	neer:	Nelso	on Ferr	eira		





Client:	WSP Canada Inc			Project Number: <u>1000-043-19</u>									
Project Name:	Local Street Packa	age 22-R-05			Location: UTM N-5528703, E-630245 (Spruce St/Clifton St Alley)								
Contractor:	Maple Leaf Drilling]			Ground Elevation	: Top of	Pavem	ent					
Method:	125mm Solid Stem Aug	ger, B40 Mobile T	ruck Mount		Date Drilled:	Februa	ary 7, 20	22					
Sample T	ype:	Grab (G)		Shelby Tube (T)	Split Spoon (SS) / SP	T 💌	Split Bar	rel (SB) / l	_PT [Core (C)	
Particle S	ize Legend:	Fines	Clay	Silt	Sand		Gravel		Cobbles	• 🗙	Bou	lders	
Depth (m) Soil Symbol		MAT	ERIAL DES	CRIPTION		Sample Type	Sample Number	Bulk U (kN/17 18 Particle S	m ³) 19 20 2 Size (%) 60 80 10	00	Streng Test △ Tor Pock S 0 Field	ed Shear th (kPa) t Type vane △ et Pen. • Qu ⊠ I Vane ○	
	SPHALT - 20 mm th DNCRETE - 270 mr	n thick				PC	C22-34						
-0.5-CL	AY - silty, trace sar - black - frozen to 1.5 m - high plasticity - AASHTO: A-7-6	depth, moist a		m when thawed			G99	•					
-1.0-							G100 G101						
- b	rown, no organics t	pelow 1.2 m					G102	•		4			
- 1.5- - fil	rm to stiff below 1.5	5 m					G103	•			△		
-2.0	ght brown below 2.0	0 m					G104 G105	•			4		
1) 2) 3) 4) alle		ughing observe 2.3 m immedia I with auger cu n back alley of	ed. tely after drill uttings, granu house #111	llar fill and cold pa 5 Spruce street, 2	m East of West edg								
Logged By: A	sad Dustmamatov		Reviewe	d By : Angela F	dler-Kliewer	Pi	roiect E	ngineer:	Nelson F	erreira	ı		



GEOTECHNICOL

Clier	nt:	WSP Canad	a Inc			Project Number:	1000-0	43-19				
Proje	ect Name	: Local Street	Package 22-R-0	5		Location:	UTM N	-552875	57, E-63029	6 (Spruce	St/Clifton S	t Alley)
Cont	ractor:	Maple Leaf [Drilling			Ground Elevation:	Top of	Paveme	ent			
Meth	od:	125mm Solid St	tem Auger, B40 Mobi	e Truck Mount		Date Drilled:	Februa	ry 7, 202	22			
	Sample	Туре:	Grab (G		Shelby Tube (T)	Split Spoon (S	SS) / SPT		Split Barrel	(SB) / LPT	Co	ore (C)
	Particle	Size Legend:	Fines	Clay	Silt	Sand		Gravel	[7] c	obbles	Bould	lers
Depth (m)	Soil Symbol		N	IATERIAL DESC	RIPTION		Sample Type	amp	Bulk Uni (kN/m³) 17 18 19 Particle Size 20 40 60 PL MC 20 40 66	20 21 (%) 0 80 100 LL	Undraine Strength Test △ Torv. Pocket △ Q ○ Field 50 100	n (kPa) <u>Type</u> ane ∆ t Pen. ∳ u ⊠
-0.5-		 black 	50 mm thick ce sand, trace or oist and firm whe icity					22-35	•			
1000-043-19_A_AD.GPJ_TREK.GDT_2/24/22 		light browfrozen to	1.5 m depth, moi ermediate plastici	st and soft when	thawed		G	107 108 109				
		CLAY - silty - brown - moist, stif - high plast - AASHTO:	icity				G	1110	•		△ •	
SUB-SURFACE LOG LOGS ZUZZ-UZ-08 LOCAL SIRE! PACKAGE ZZ-K-09		1) No seepage of 2) Test hole ope 3) Test hole bac 4) Test hole bac 4) Test hole loca of alley.	HOLE AT 2.3 m I or sloughing obse en to 2.3 m imme ckfilled with auge ated in back alley aple was collected	erved. diately after drillir cuttings, granula of house #1038	ar fill and cold pa Clifton street, 2	m North of South edg	je					
∯ Logg	ged By:	Asad Dustman	natov	Reviewed	By : Angela F	dler-Kliewer	_ Pr	oject Er	ngineer: <u>N</u>	lelson Ferr	eira	



2022 Local Street Package - 22-R-05 Sub-Surface Investigation

Spruce Street/Clifton Street Alley - between Sargent Avenue and Ellice Avenue

Test Hole	Tanklinia Landina	Paveme	ent Surface	Pavement Str	ucture Material		Sample	Depth (m)	Moisture	Grain Size Analysis			3	At	Atterberg Limits	
No.	Test Hole Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Subgrade Description	Top (m)	Bottom (m)	Content (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
		Asphalt	-	Concrete	180	Clay; AASHTO: A-7-6 (I)	0.3	0.5	29							
	UTM : 14U 5528596 N,					Clay; AASHTO: A-7-6 (I)	0.6	0.8	32							
	630285 E					Clay; AASHTO: A-7-6 (I)	0.9	1.1	35							
TH22-13	Located in back alley of house #992 Clifton St.,					Clay; AASHTO: A-7-6 (I)	1.2	1.4	35							
	1.0 m North of South					Clay; AASHTO: A-7-6 (I)	1.5	1.7	36							
	edge of alley.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	40							
						Clay; AASHTO: A-7-6 (I)	2.1	2.3	43							
		Asphalt	-	Concrete	260	Silt and Clay; AASHTO: A-7-6 (24)	0.3	0.5	39							
	UTM : 14U 5528546 N,					Silt and Clay; AASHTO: A-7-6 (24)	0.6	0.8	32							
	630243 E					Silt and Clay; AASHTO: A-7-6 (24)	0.9	1.1	31	38	51	11	0	16	43	27
TH22-14	Located in back alley of house #1065 Spruce St.					Silt and Clay; AASHTO: A-7-6 (24)	1.2	1.4	29							
	1.5 m West of East edge					Silt; AASHTO: A-4 (I)	1.5	1.7	10							
	of alley.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	40							
						Clay; AASHTO: A-7-6 (I)	2.1	2.3	40							
		Asphalt	20	Concrete	270	Clay; AASHTO: A-7-6 (45)	0.3	0.5	30							
	UTM : 14U 5528703 N,					Clay; AASHTO: A-7-6 (45)	0.6	0.8	30							
	630245 E					Clay; AASHTO: A-7-6 (45)	0.9	1.1	30	58	35	7	0	17	62	45
TH22-15	Located in back alley of house #1115 Spruce St.,					Clay; AASHTO: A-7-6 (45)	1.2	1.4	30							
	2.0 m East of West edge					Clay; AASHTO: A-7-6 (45)	1.5	1.7	34							
	of alley.					Clay; AASHTO: A-7-6 (45)	1.8	2.0	44							
						Clay; AASHTO: A-7-6 (45)	2.1	2.3	40							
		Asphalt	30	Concrete	250	Clay; AASHTO: A-7-6 (I)	0.3	0.5	37							
	UTM : 14U 5528596 N,					Silt; AASHTO: A-4 (3)	0.6	0.8	26							
	630285 E					Silt; AASHTO: A-4 (3)	0.9	1.1	26	15	74	11	0	18	24	6
TH22-16	Located in back alley of house #1038 Clifton St.					Silt; AASHTO: A-4 (3)	1.2	1.4	26							
	back alley, 2.0 m North of					Clay; AASHTO: A-7-6 (I)	1.5	1.7	23							
	South edge of alley.					Clay; AASHTO: A-7-6 (I)	1.8	2.0	36							
						Clay; AASHTO: A-7-6 (I)	2.1	2.3	42							

Project No. 1000-043-19
Client WSP Canada Inc

Project Street Package 22-R-05 - Spruce Clifton Alley

Sample Date07-Feb-22Test Date09-Feb-22TechnicianAD

Test Hole	TH22-13	TH22-13	TH22-13	TH22-13	TH22-13	TH22-13
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0
Sample #	G85	G86	G87	G88	G89	G90
Tare ID	F48	C13	N15	E46	Z81	N112
Mass of tare	8.5	8.4	8.5	8.4	8.6	8.3
Mass wet + tare	184.8	213.2	155.8	137.0	198.2	177.5
Mass dry + tare	145.3	163.8	117.3	103.5	147.8	129.1
Mass water	39.5	49.4	38.5	33.5	50.4	48.4
Mass dry soil	136.8	155.4	108.8	95.1	139.2	120.8
Moisture %	28.9%	31.8%	35.4%	35.2%	36.2%	40.1%

Test Hole	TH22-13	TH22-14	TH22-14	TH22-14	TH22-14	TH22-14
Depth (m)	2.1 - 2.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7
Sample #	G91	G92	G93	G94	G95	G96
Tare ID	F63	P36	AB87	H50	A102	F137
Mass of tare	8.4	8.5	6.7	8.4	8.3	8.6
Mass wet + tare	188.5	177.0	170.8	376.0	167.2	311.5
Mass dry + tare	134.3	130.2	131.4	289.3	131.3	283.6
Mass water	54.2	46.8	39.4	86.7	35.9	27.9
Mass dry soil	125.9	121.7	124.7	280.9	123.0	275.0
Moisture %	43.1%	38.5%	31.6%	30.9%	29.2%	10.1%

Test Hole	TH22-14	TH22-14	TH22-15	TH22-15	TH22-15	TH22-15
Depth (m)	1.8 - 2.0	2.1 - 2.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4
Sample #	G97	G98	G99	G100	G101	G102
Tare ID	AB57	Z09	P05	Z75	N91	AA20
Mass of tare	6.6	8.4	8.6	8.6	8.7	6.7
Mass wet + tare	211.5	186.6	205.7	300.8	447.8	317.0
Mass dry + tare	153.1	135.6	160.3	233.3	345.5	245.0
Mass water	58.4	51.0	45.4	67.5	102.3	72.0
Mass dry soil	146.5	127.2	151.7	224.7	336.8	238.3
Moisture %	39.9%	40.1%	29.9%	30.0%	30.4%	30.2%

Project No. 1000-043-19
Client WSP Canada Inc

Project Street Package 22-R-05 - Spruce Clifton Alley

Sample Date07-Feb-22Test Date09-Feb-22TechnicianAD

Test Hole	TH22-15	TH22-15	TH22-15	TH22-16	TH22-16	TH22-16
Depth (m)	1.5 - 1.7	1.8 - 2.0	2.1 - 2.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1
Sample #	G103	G104	G105	G106	G107	G108
Tare ID	AA50	W25	D40	W79	A104	W53
Mass of tare	6.7	8.4	8.3	8.7	8.5	8.4
Mass wet + tare	344.3	251.7	208.9	278.1	288.5	405.1
Mass dry + tare	259.0	177.8	151.2	204.9	230.3	324.0
Mass water	85.3	73.9	57.7	73.2	58.2	81.1
Mass dry soil	252.3	169.4	142.9	196.2	221.8	315.6
Moisture %	33.8%	43.6%	40.4%	37.3%	26.2%	25.7%

Test Hole	TH22-16	TH22-16	TH22-16	TH22-16	
Depth (m)	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0	2.1 - 2.3	
Sample #	G109	G110	G111	G112	
Tare ID	N36	W87	A8	E33	
Mass of tare	8.4	8.5	8.1	8.5	
Mass wet + tare	231.8	288.8	240.9	193.6	
Mass dry + tare	186.4	236.9	179.4	138.9	
Mass water	45.4	51.9	61.5	54.7	
Mass dry soil	178.0	228.4	171.3	130.4	
Moisture %	25.5%	22.7%	35.9%	41.9%	



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Atterberg Limits ASTM D4318-10e1

Project No. 1000-043-19

Client WSP Canada Inc

Project Local Street Package 22-R-05-Spruce Clifton Alley

Test Hole TH22-14

 Sample #
 G94

 Depth (m)
 0.9 - 1.1

 Sample Date
 0.7-Feb-22

 Sample Date
 07-Feb-22

 Test Date
 11-Feb-22

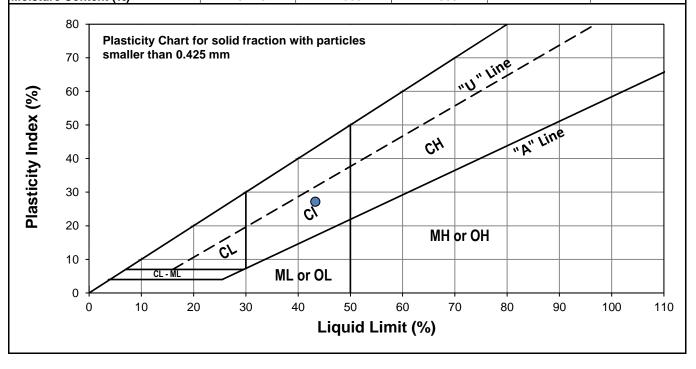
 Technician
 AD



Liquid Limit 43 Plastic Limit 16 Plasticity Index 27

Liquid Limit

Liquid Lillin				
Trial #	1	2	3	
Number of Blows (N)	15	20	30	
Mass Tare (g)	14.081	13.993	14.178	
Mass Wet Soil + Tare (g)	27.772	25.840	27.779	
Mass Dry Soil + Tare (g)	23.473	22.186	23.736	
Mass Water (g)	4.299	3.654	4.043	
Mass Dry Soil (g)	9.392	8.193	9.558	
Moisture Content (%)	45.773	44.599	42.300	



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.212	14.066			
Mass Wet Soil + Tare (g)	23.013	21.604			
Mass Dry Soil + Tare (g)	21.798	20.547			
Mass Water (g)	1.215	1.057			
Mass Dry Soil (g)	7.586	6.481			
Moisture Content (%)	16.016	16.309			



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or specific tests as listed on www.ccil.co

Project No. <u>1000-043-19</u>

Client WSP Canada Inc

Project Local Street Package 22-R-05-Spruce Clifton Alley

 Test Hole
 TH22-15

 Sample #
 G101

 Depth (m)
 0.9 - 1.1

 Sample Date
 07-Feb-22

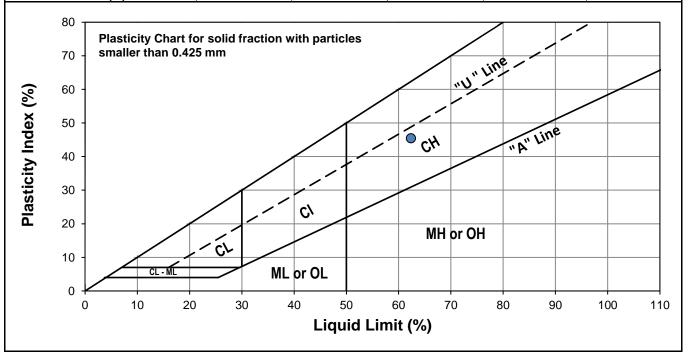
 Test Date
 11-Feb-22

 Technician
 AD

Liquid Limit 62
Plastic Limit 17
Plasticity Index 45

Liquid Limit

Liquid Littlit								
Trial #	1	2	3					
Number of Blows (N)	19	29	33					
Mass Tare (g)	14.101	13.974	14.078					
Mass Wet Soil + Tare (g)	23.374	23.923	24.932					
Mass Dry Soil + Tare (g)	19.761	20.131	20.830					
Mass Water (g)	3.613	3.792	4.102					
Mass Dry Soil (g)	5.660	6.157	6.752					
Moisture Content (%)	63.834	61.588	60.752					



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.002	14.059			
Mass Wet Soil + Tare (g)	21.798	20.112			
Mass Dry Soil + Tare (g)	20.675	19.234			
Mass Water (g)	1.123	0.878			
Mass Dry Soil (g)	6.673	5.175			
Moisture Content (%)	16.829	16.966			



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Atterberg Limits ASTM D4318-10e1

or specific tests as listed on www.ccil.co

Project No. 1000-043-19

Client WSP Canada Inc

Project Local Street Package 22-R-05- Spruce Clifton Alley

 Test Hole
 TH22-16

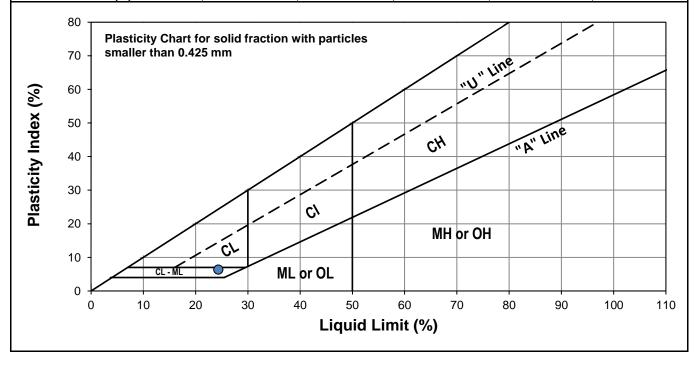
 Sample #
 G108

| Depth (m) | 0.9 - 1.1 | | 07-Feb-22 | | | 11-Feb-22 | | | Technician | AD | | AD | | |

Liquid Limit 24
Plastic Limit 18
Plasticity Index 6

Liquid Limit

Liquid Littiit	Liquid Littiit								
Trial #	1	2	3						
Number of Blows (N)	18	21	31						
Mass Tare (g)	14.048	14.208	14.285						
Mass Wet Soil + Tare (g)	28.726	26.420	29.072						
Mass Dry Soil + Tare (g)	25.727	23.972	26.261						
Mass Water (g)	2.999	2.448	2.811						
Mass Dry Soil (g)	11.679	9.764	11.976						
Moisture Content (%)	25.679	25.072	23.472						



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.944	14.062			
Mass Wet Soil + Tare (g)	21.435	22.858			
Mass Dry Soil + Tare (g)	20.302	21.505			
Mass Water (g)	1.133	1.353			
Mass Dry Soil (g)	6.358	7.443			
Moisture Content (%)	17.820	18.178			



Project No. 1000-043-19
Client WSP Canada Inc.

Project Local Street Package 22-R-05-Spruce Clifton Alley

 Test Hole
 TH22-14

 Sample #
 G94

 Depth (m)
 0.9 - 1.1

 Sample Date
 7-Feb-22

 Test Date
 11-Feb-22

 Technician
 NM



Gravel	0.1%
Sand	11.1%
Silt	50.7%
Clay	38.1%

Particle Size Distribution Curve Sand Gravel Silt Clay Coarse Coarse Fine Fine Medium 100 90 80 Percent Finer by Weight 70 60 50 40 30 20 10 0 0.001 0.01 0.1 10 100 Particle Size (mm)

Gravel		Sa	ınd	Silt and Clay		
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	
50.0	100.00	4.75	99.89	0.0750	88.74	
37.5	100.00	2.00	98.81	0.0557	81.64	
25.0	100.00	0.850	98.34	0.0412	71.14	
19.0	100.00	0.425	97.53	0.0299	64.96	
12.5	100.00	0.180	95.34	0.0194	59.09	
9.50	100.00	0.150	94.82	0.0155	56.00	
4.75	99.89	0.075	88.74	0.0114	52.66	
				0.0082	49.63	
				0.0058	46.60	
				0.0042	43.88	
				0.0029	42.58	
				0.0021	38.74	
				0.0012	33.49	



Project No. 1000-043-19
Client WSP Canada Inc.

Project Local Street Package 22-R-05- Spruce Clifton Alley

 Test Hole
 TH22-15

 Sample #
 G101

 Depth (m)
 0.9 - 1.1

 Sample Date
 7-Feb-22

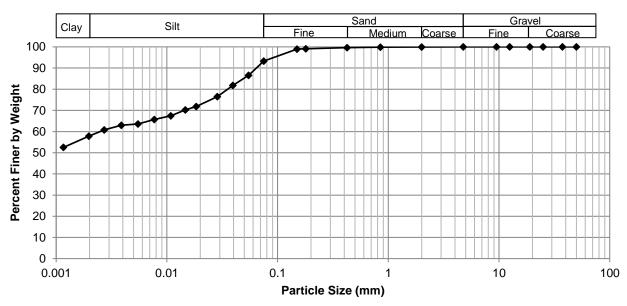
 Test Date
 11-Feb-22

 Technician
 NM



Gravel	0.0%
Sand	6.7%
Silt	35.4%
Clay	57.9%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay		
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	
50.0	100.00	4.75	100.00	0.0750	93.30	
37.5	100.00	2.00	99.94	0.0547	86.52	
25.0	100.00	0.850	99.84	0.0395	81.84	
19.0	100.00	0.425	99.66	0.0286	76.52	
12.5	100.00	0.180	99.12	0.0185	71.84	
9.50	100.00	0.150	98.96	0.0147	70.28	
4.75	100.00	0.075	93.30	0.0108	67.46	
				0.0077	65.71	
				0.0055	63.59	
				0.0039	63.02	
				0.0027	60.77	
				0.0020	57.83	
				0.0012	52.52	



Project No. 1000-043-19
Client WSP Canada Inc.

Project Local Street Package 22-R-05-Spruce Clifton Alley

 Test Hole
 TH22-16

 Sample #
 G108

 Depth (m)
 0.9 - 1.1

 Sample Date
 7-Feb-22

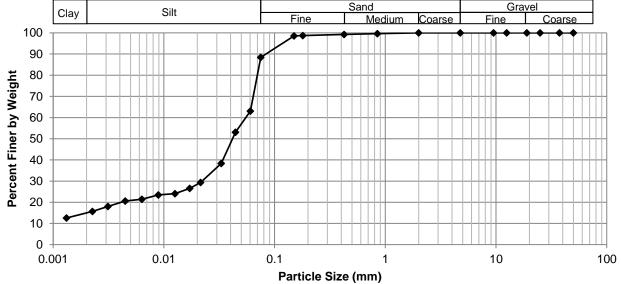
 Test Date
 11-Feb-22

 Technician
 NM



Gravel	0.0%
Sand	11.5%
Silt	73.7%
Clay	14.8%

Particle Size Distribution Curve Clay Silt Sand Fine Medium Coa



Gravel		Sa	ınd	Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	88.47
37.5	100.00	2.00	100.00	0.0605	63.08
25.0	100.00	0.850	99.60	0.0444	53.07
19.0	100.00	0.425	99.23	0.0330	38.38
12.5	100.00	0.180	98.74	0.0215	29.37
9.50	100.00	0.150	98.58	0.0171	26.56
4.75	100.00	0.075	88.47	0.0126	24.06
				0.0089	23.50
				0.0063	21.44
				0.0045	20.57
				0.0031	18.00
				0.0023	15.69
				0.0013	12.57



Project No. 1000-043-19

Client WSP

Project 2022 Local Streets Package

Sample # Combined bulk samples

RS

Source TH22-13, 15 (Spruce Clifton Alley)

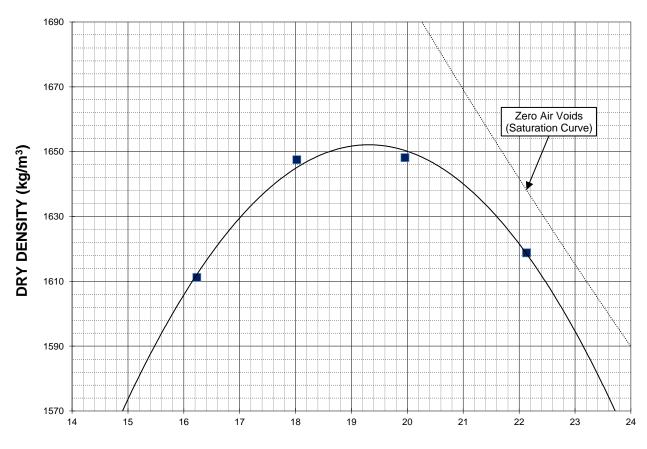
Material Clay

Technician

Sample Date07-Feb-22Test Date10-Feb-22

Maximum Dry Density (kg/m3)	1652
Optimum Moisture (%)	19.3

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1873	1944	1977	1977	
Dry Density (kg/m ³)	1611	1648	1648	1619	
Moisture Content (%)	16.2	18.0	20.0	22.1	



MOISTURE CONTENT (%)



California Bearing Ratio Test Data Sheet ASTM D1883-16

Project No. 1000-043-19 **Source** TH22-13, 15

Client WSP Material Clay

Project2022 Local Streets PackageSample Date2022-02-07Sample #Bulk (Spruce Clifton Alley)Test Date2022-02-12

Technician DS

Proctor Results (ASTM D698) CBR Sample Compaction

Maximum Dry Density 1652 kg/m3 Dry Density 1570 kg/m3
Optimum Moisture Content 19.3 % Initial Moisture Content 21.6 %

Material Retained on 19 mm Sieve 0.0 % Relative Density 95.0 % SPMDD

Soaking Results CBR Results

 Surcharge
 4.54 kg
 CBR at 2.54 mm
 6.2 %

 Swell
 0.4 %
 CBR at 5.08 mm
 4.9 %

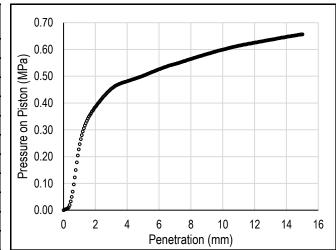
 Moisture Content in top 25 mm
 24.0 %
 Zero Correction
 0 mm

Immersion Period 96 h

Test Data

Measured Corrected Penetration (mm) Pressure (MPa) Pressure (MPa) 0.10 0.10 0.64 0.31 0.31 1.27 0.38 0.38 1.91 2.54 0.43 0.43 0.46 0.46 3.18 3.81 0.48 0.48 4.45 0.49 0.49 5.08 0.50 0.50 7.62 0.56 0.56 0.60 0.60 10.16 12.70 0.63 0.63

Load/Penetration Curve



Comments:



Project No. 1000-043-19

Client WSP

Project 2022 Local Streets Package

Sample # Combined bulk samples

RS

Source TH22-14, 16 (Spruce Clifton Alley)

Material Silt

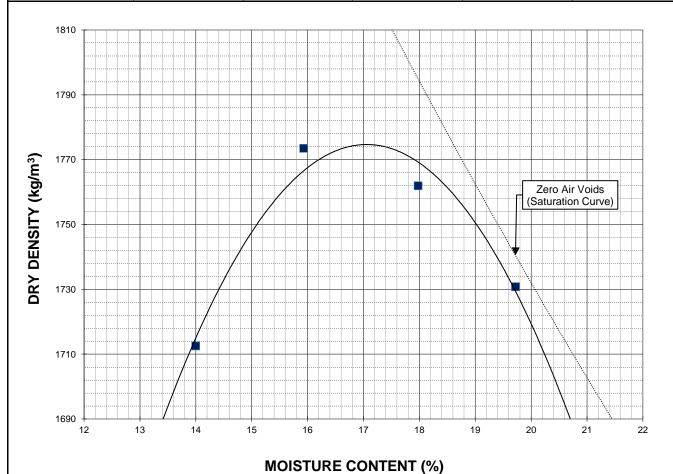
Technician

Sample Date07-Feb-22Test Date10-Feb-22



Maximum Dry Density (kg/m3)	1775
Optimum Moisture (%)	17.1

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1952	2056	2079	2072	
Dry Density (kg/m ³)	1713	1773	1762	1731	
Moisture Content (%)	14.0	15.9	18.0	19.7	





California Bearing Ratio Test Data Sheet ASTM D1883-16

Project No. 1000-043-19 **Source** TH22-14, 16

Client WSP Material Sil

Project2022 Local Streets PackageSample Date2022-02-07Sample #Bulk (Spruce Clifton Alley)Test Date2022-02-14

Technician DS

Proctor Results (ASTM D698) CBR Sample Compaction

Maximum Dry Density 1775 kg/m3 Dry Density 1701 kg/m3
Optimum Moisture Content 17.0 % Initial Moisture Content 19.0 %

Material Retained on 19 mm Sieve 0.0 % Relative Density 95.8 % SPMDD

Soaking Results CBR Results

 Surcharge
 4.54 kg
 CBR at 2.54 mm
 5.9 %

 Swell
 0.2 %
 CBR at 5.08 mm
 4.8 %

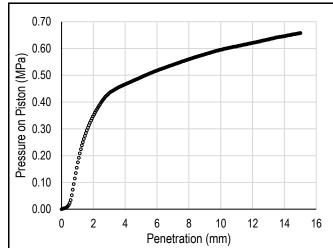
 Moisture Content in top 25 mm
 19.9 %
 Zero Correction
 0 mm

Immersion Period 96 h

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.05	0.05
1.27	0.24	0.24
1.91	0.34	0.34
2.54	0.40	0.40
3.18	0.44	0.44
3.81	0.46	0.46
4.45	0.48	0.48
5.08	0.50	0.50
7.62	0.55	0.55
10.16	0.60	0.60
12.70	0.63	0.63

Load/Penetration Curve



Comments:





Photo 1: Pavement Core Sample at Test Hole TH22-13



Photo 2: Pavement Core Sample at Test Hole TH22-14

Project No. 1000 043 19 February 2022





Photo 3: Pavement Core Sample at Test Hole TH22-15



Photo 4: Pavement Core Sample at Test Hole TH22-16

Project No. 1000 043 19 February 2022



Appendix E

Summary Table, Pavement Core Photos, and Summary of Pavement Compressive Strength – Forest Park Drive



2022 Local Street Package - 22-R-05

Forest Park Drive: between Airlies Street and Sinclair Street

		Paveme	Pavement Surface		Pavement Structure Ma	terial
Pavement Core No.	Pavement Core Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Corrected Compressive Strength (Mpa)
PC22-01	UTM: 5534224 m N, 633285 m E; Located 23 m East of Airlies Street and Forest Park Drive intersection, Eastbound lane, 1.5 m North of South curb.	Asphalt	60	Concrete	110	61.29
P(.//-()/	UTM : 5534199 m N, 633303 m E; Located 26 m West of Sweetwood Bay and Forest Park Drive intersection, Westbound lane, 1.5 m South of North curb.	Asphalt	50	Concrete	150	-
	UTM : 5534164 m N, 633337 m E; Located 23 m East of Sweetwood Bay and Forest Park Drive intersection, Eastbound lane, 1.5 m North of South curb.	Asphalt	50	Concrete	140	69.07
PC22-04	UTM: 5534140 m N, 633368 m E; Located 94 m West of Sinclair Street and Forest Park Drive intersection, Westbound lane, 1.5 m South of North curb.	Asphalt	50	Concrete	140	-
PC22-05	UTM: 5534095 m N, 633408 m E; Located 48 m West of Sinclair Street and Forest Park Drive intersection, Eastbound lane, 1.5 m North of South curb.	Asphalt	40	Concrete	160	66.00





Photo 1: Pavement Core Sample at PC22-01



Photo 2: Pavement Core Sample at PC22-02





Photo 3: Pavement Core Sample at PC22-03



Photo 4: Pavement Core Sample at PC22-04





Photo 5: Pavement Core Sample at PC22-05



Concrete Core Compressive Strength Report

CSA A23.2-14C

Project No. 1000-043-19 **Date** February 11, 2022

Project 2022 Local Street Package - 22-R-05 Technician NM

Client WSP Group Canada Inc.

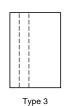
		Date	Date Date of Age at Diam. Length Moisture	Age at	ge at Diam.	am. Length	ath Moisture	Compressive S	Break	Correction Factors*				*	
Core Location	Core ID	Received		Uncorrected f _{conc}	Corrected* f _c	Туре	F _{I/d}	F_{dia}	F_{mc}	F_D	F _{reinf}				
Forest Park Drive	PC01	2022-01-26	2022-02-11	-	95	100	Soaked 48 h	57.59	61.29	1	0.92	1.00	1.09	1.06	1.00
Forest Park Drive	PC03	2022-01-26	2022-02-11	-	95	111	Soaked 48 h	63.47	69.07	1	0.94	1.00	1.09	1.06	1.00
Forest Park Drive	PC05	2022-01-26	2022-02-11	-	95	120	Soaked 48 h	59.85	66.00	2	0.95	1.00	1.09	1.06	1.00

Comments

*Correction factors $F_{I/d}$, F_{dia} , F_{mc} , and F_D calculated as per ACI 214.4R-03, and correction factor F_{reinf} calculated as per Khoury et al. (2014): $f_c = f_{conc}F_{I/d}F_{dia}F_{mc}F_DF_{reinf}$













Reviewed by (print): Angela Fidler-Kliewer, C. Tech. Signature: Angela Fidler-Kliewer

Table 1	Factors in	volved in	interpretation	of core	results	by different co	odes.
							The Broke Street Street

List	Code/standard	Edition	n Factors Considered								
			Aspect ratio	Diameter	Reinforcing	Moisture	Damage	Direction			
1	Egyptian Code/Standard Specification	2008	√		√			√			
2	British Code/Standard Specification	2003	V		1			1			
3	American Concrete Institute ACI	1998	V								
		2012	1	V		1	1				
4	European Standard Specification	1998	1	1	1		1				
		2009	1		J						
5	Japanese Standard	1998	1								
6	Concrete Society	1987	1		1		1	1			

In addition, for core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect should be assessed by replacing the term $(\Phi_r * d)$ by the term $(\sum \Phi_r * d)$.

It should be pointed out that above equations used to interpret the core concrete strength to the in-situ concrete cube strength have been developed based on a set of assumptions and through many converting process. It is also of interest to note that the damage effect is considered in the development of the formulas in indirect way. The subject derivation and detailed formulas may be seen elsewhere [14].

3.2. American Concrete Institute (ACI)

3.2.1. Former ACI Code (2002) & Current ASTM (2009)

The methodology of core interpretation given in the former ACI code was remained without changes for decades and up to Year (2003). The in-place strength of concrete cylinder at the location from which a core test specimen was extracted can be computed using the equation:

$$f_{\rm cy} = F_{l/d} \cdot f_{\rm core} \tag{4}$$

where $f_{\rm cy}$ is the equivalent in-place concrete cylinder strength, $f_{\rm core}$ is concrete core strength, and $F_{l/d}$ is the strength correction factor for aspect ratio.

The former ACI code does not include any equation to calculate the correction factor $(F_{I/d})$; however, the code gives different values for this term that is associated with different aspect ratios (I/d) as given in Table 2. It should also be noted that the approach of current ASTM is similar to that mentioned above. The only considered variable is the aspect ratio (I/d). It should be noted that identical approach to that mentioned above is still effective in ASTM C42/C42M-03 [10].

3.2.2. Current ACI Code (2012) [15]

Starting from Year 2003, significant changes have been made to the relevant ACI Code provisions regarding the interpreta-

Table 2 Mean values for factor $F_{I/d}$ according to ACI Code (1998) and ASTM.

	Specimen	length-to-dian	neter ratio, l/d		
	1.00	1.25	1.50	1.75	
$F_{l/d}$	0.87	0.93	0.96	0.98	

tion of core strength test results. New factors have been considered. These include core diameter, moisture content of core sample, core damage associated with drilling, in addition to the effect of aspect ratio that was previously considered in the former ACI edition (1998). According to the ACI 214.4R-03, the in-place concrete strength can be computed using the equation:

using the equation:
$$f_c = F_{i/d} \cdot F_{dia} \cdot F_{mc} \cdot F_D \cdot f_{core} \cdot F_{$$

where f_c is the equivalent in-place concrete cylinder strength, $f_{\rm core}$ is concrete core strength, $F_{l/d}$ is strength correction factor for aspect ratio, $F_{\rm dia}$ is strength correction factors for diameter, $F_{\rm mc}$ is strength correction factor for moisture condition of core sample, and F_D is the strength correction factor that accounts for effect of damage sustained during core drilling including micro-cracking and undulations at the drilled surface and cutting through coarse-aggregate particles that may subsequently pop out during testing.

The ACI committee considered the correction factors presented in Table 3 for converting core strengths into equivalent in-place strengths based on the work reported by Bartlett and MacGregor [6]. It should be noted that the magnitude of

Table 3 Strength correction factors according to ACI 214.4R-03

List	Factors	Mean values
(1) ^b	$F_{l/d}: l/d$ ratio	
	As-received	$1 - \{0.130 - \alpha f_{\text{core}}\} \left(2 - \frac{l}{d}\right)^2$
	Soaked 48 h	$1 - \{0.117 - \alpha f_{\text{core}}\} \left(2 - \frac{1}{d}\right)^2$
	Air dried	$1 - \{0.144 - \alpha f_{\text{core}}\} (2 - \frac{1}{d})^2$
(2)	F _{dia} : core diameter	
	50 mm	1.06
	100 mm	1.00
	150 mm	0.98
(3)	$F_{\rm mc}$: core moisture content	
	As-received	1.00
	Soaked 48 h	1.09
	Air dried ^a	0.96
(4)	F_D : damage due to drilling	1.06

^a Standard treatment specified in ASTM C 42/C 42M.

^b Constant α equals 4.3(10⁻⁴) 1/MPa for f_{core} in MPa.

Table 6	List of co	omparisor	is betw	een tes	ted cor	es to de	etermin	e.										
	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A
A1	+0	•	+0	10	10		•		THE ST		•	# MI		A	\wedge			
A2																		
A3						-				-								
A4																		
A5																		
A6								-AO	HAO									
A7								-AO										
A8		•		•	•													
A9																		
A10																		
A11																		
A12		•		•	•													
A13																		
A14				•														
A15		•																
A16	••																	
A17	•																	
418																		

• Diameter of steel bar.

▲ Distance of steel bar from nearly end of core.

■ Number of steel bars and spacing between bars.

• Distance of steel bar from vertical axis of specimen.

This brief review indicated that the various proposed relationships for correction factors are all nonlinear. It should be noted that the equations given by the Egyptian Code takes into account most variables that may affect the interpretation of the results; however, the code ignores the deterioration of steel-concrete bond that may occur and also the position of the reinforcement from vertical axis of core specimens.

Weighted nonlinear regression analysis has been performed to determine the factor (F_{reinf}) with the use of the software "SAS" package and "Data Fit." This shows that the correction factor for reinforcement (F_{reinf}) is given by the following expression:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{\left[\Phi_r \times r + \Phi_r \times (S/10)\right]}{\Phi_c * L} \times \frac{1.13}{f_{\text{core}}^{0.015}}\right]$$

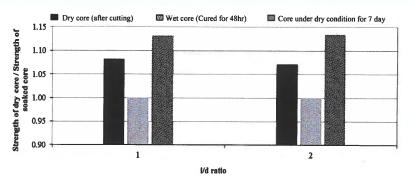
• For core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect is assessed by replacing the term $(\Phi_r * r)$ by $(\sum \Phi_r * r)$ as follows:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{\sum [\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_r * I_r}\right] \times \frac{1.13}{\rho_{0.015}}$$
(13)

where F_{reinf} is the correction factor for reinforcement, Φ_r is the diameter of the reinforcement, Φ_c is the diameter of the concrete specimen, r is the distance of axis of bar from nearer end of specimen, S is the distance of axis of bar from axis of core specimen, L is the length of the specimen after end preparation by grinding or capping, and f_{core} is the concrete core strength (kg/cm²).

6.1.6. Effect of moisture condition of core

Results of about 100 cores indicate that the strength of cores left to dry in air for 7 days is on average 13% greater than that of cores soaked at least 40 h before testing. The strength of cores with negligible moisture gradient and tested after cutting is found to be 7-9% larger than that of soaked cores as shown in Fig. 20. The authors strongly recommend to use a correction factor accounting for moisture condition (F_m) equals to 1.09 and 0.96, respectively, for cores tested after 48 h soaked in water and for those tested after 7 days dry in air.



Effect of core moisture condition on core strength for different aspect ratios (l/d).



Λ	n	n	_	n	A	ix	F
А	μ	μ	е		u	IX	Г

Summary Table, Pavement Core Photos, and Summary of Pavement Compressive Strength – Grundy Avenue



2022 Local Street Package - 22-R-05

Grundy Avenue: between Ingersoll Street and Garfield Street North

		Paveme	ent Surface		Pavement Structure Ma	terial
Pavement Core No.	Pavement Core Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Corrected Compressive Strength (Mpa)
PC22-18	UTM : 5529555 m N, 631110 m E; Located 30 m East of Sherburn Street and Grundy Avenue intersection, Westbound lane,	Asphalt	-	Concrete	170	52.49
	1.5 m South of North curb.					
PC22-19	UTM: 5529554 m N, 631031 m E; Located 34 m East of Garfield Street and Grundy Avenue intersection, Eastbound lane,	Asphalt	-	Concrete	170	67.60
1 022-19	1.5 m North of South curb.					
D000 00	UTM: 5529552 m N, 631132 m E; Located 30 m West of Ingersoll Street and Grundy Avenue intersection, Eastbound lane,	Asphalt	-	Concrete	150	-
PC22-36	1.5 m North of South curb.	ound lane, Asphalt - Concrete 170 Asphalt - Concrete 170 Asphalt - Concrete 170				





Photo 1: Pavement Core Sample at PC22-18



Photo 2: Pavement Core Sample at PC22-19





Photo 3: Pavement Core Sample at PC22-36



Concrete Core Compressive Strength Report

CSA A23.2-14C

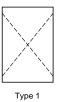
Project No.	1000-043-19	Date February 11, 2022
Project	2022 Local Street Package - 22-R-05	Technician NM

Client WSP Group Canada Inc.

Ī			Date	Date of	Age at	Diam.	Length	Moisture	Compressive S	Strength (MPa)	Break	(Correc	tion Fa	actors	*
	Core Location	Core ID	Received	Break	Break	(mm)	(mm)		Uncorrected f _{conc}	Corrected* f _c	Туре	F _{I/d}	F_{dia}	F_{mc}	F_D	F_{reinf}
	Grundy Avenue	PC18	2022-01-31	2022-02-11	-	95	153	Soaked 48 h	45.92	52.49	1	0.99	1.00	1.09	1.06	1.00
	Grundy Avenue	PC19	2022-01-31	2022-02-11		95	156	Soaked 48 h	58.95	67.60	1	0.99	1.00	1.09	1.06	1.00

Comments

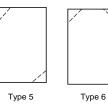
*Correction factors F_{I/d}, F_{dia}, F_{mc}, and F_D calculated as per ACI 214.4R-03, and correction factor F_{reinf} calculated as per Khoury et al. (2014): $f_c = f_{conc}F_{l/d}F_{dia}F_{mc}F_DF_{reinf}$











Reviewed by (print):

Angela Fidler-Kliewer, C. Tech. Signature: Angela Fidler-Kliewer

Table 1	Factors involved	in interpretation	of core results	by different codes.
A SECURITION OF		I SAN DESTRUCTION OF THE	and the state of the state of the state of	The state of the s

List	Code/standard	Edition	Factors Considered										
			Aspect ratio	Diameter	Reinforcing	Moisture	Damage	Direction					
1	Egyptian Code/Standard Specification	2008	√		√			√					
2	British Code/Standard Specification	2003	1		1			1					
3	American Concrete Institute ACI	1998	1										
		2012	1	√		V	1						
4	European Standard Specification	1998	1	V	√		1						
		2009	1		1								
5	Japanese Standard	1998	1										
6	Concrete Society	1987	1		1		1	1					

In addition, for core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect should be assessed by replacing the term $(\Phi_r * d)$ by the term $(\sum \Phi_r * d)$.

It should be pointed out that above equations used to interpret the core concrete strength to the in-situ concrete cube strength have been developed based on a set of assumptions and through many converting process. It is also of interest to note that the damage effect is considered in the development of the formulas in indirect way. The subject derivation and detailed formulas may be seen elsewhere [14].

3.2. American Concrete Institute (ACI)

3.2.1. Former ACI Code (2002) & Current ASTM (2009)

The methodology of core interpretation given in the former ACI code was remained without changes for decades and up to Year (2003). The in-place strength of concrete cylinder at the location from which a core test specimen was extracted can be computed using the equation:

$$f_{\rm cy} = F_{l/d} \cdot f_{\rm core} \tag{4}$$

where $f_{\rm cy}$ is the equivalent in-place concrete cylinder strength, $f_{\rm core}$ is concrete core strength, and $F_{l/d}$ is the strength correction factor for aspect ratio.

The former ACI code does not include any equation to calculate the correction factor $(F_{I/d})$; however, the code gives different values for this term that is associated with different aspect ratios (I/d) as given in Table 2. It should also be noted that the approach of current ASTM is similar to that mentioned above. The only considered variable is the aspect ratio (I/d). It should be noted that identical approach to that mentioned above is still effective in ASTM C42/C42M-03 [10].

3.2.2. Current ACI Code (2012) [15]

Starting from Year 2003, significant changes have been made to the relevant ACI Code provisions regarding the interpreta-

Table 2 Mean values for factor $F_{l/d}$ according to ACI Code (1998) and ASTM.

	Specimen	length-to-dian	neter ratio, l/d	
$\overline{F_{l d}}$	1.00	1.25	1.50	1.75
$F_{l/d}$	0.87	0.93	0.96	0.98

tion of core strength test results. New factors have been considered. These include core diameter, moisture content of core sample, core damage associated with drilling, in addition to the effect of aspect ratio that was previously considered in the former ACI edition (1998). According to the ACI 214.4R-03, the in-place concrete strength can be computed using the equation:

using the equation:
$$f_c = F_{I/d} \cdot F_{dia} \cdot F_{mc} \cdot F_D \cdot f_{core} \quad F_{core} \quad F_{core} \quad (5)$$

where f_c is the equivalent in-place concrete cylinder strength, $f_{\rm core}$ is concrete core strength, $F_{l/d}$ is strength correction factor for aspect ratio, $F_{\rm dia}$ is strength correction factors for diameter, $F_{\rm mc}$ is strength correction factor for moisture condition of core sample, and F_D is the strength correction factor that accounts for effect of damage sustained during core drilling including micro-cracking and undulations at the drilled surface and cutting through coarse-aggregate particles that may subsequently pop out during testing.

The ACI committee considered the correction factors presented in Table 3 for converting core strengths into equivalent in-place strengths based on the work reported by Bartlett and MacGregor [6]. It should be noted that the magnitude of

Table 3 Strength correction factors according to ACI 214.4R-03

List	Factors	Mean values
(1) ^b	$F_{l/d}: l/d$ ratio	
	As-received	$1 - \{0.130 - \alpha f_{\text{core}}\} \left(2 - \frac{1}{d}\right)^2$
	Soaked 48 h	$1 - \{0.117 - \alpha f_{\text{core}}\} \left(2 - \frac{1}{d}\right)^2$
	Air dried ^a	$1 - \{0.144 - \alpha f_{\text{core}}\} (2 - \frac{1}{d})^2$
(2)	F _{dia} : core diameter	
	50 mm	1.06
	100 mm	1.00
	150 mm	0.98
(3)	$F_{\rm mc}$: core moisture content	
	As-received	1.00
	Soaked 48 h	1.09
	Air dried ^a	0.96
(4)	F_D : damage due to drilling	1.06

^a Standard treatment specified in ASTM C 42/C 42M.

^b Constant α equals 4.3(10⁻⁴) 1/MPa for f_{core} in MPa.

Table 6	List of co	omparisor	is betw	een tes	ted cor	es to de	etermin	e.										
	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A
A1	+0	•	+0	10	10		•				•	# MI		A	\wedge		1/18	
A2																		
A3						-				-								
A4																		
A5																		
A6								-AO	HAO									
A7								-AO										
A8		•		•	•													
A9																		
A10																		
A11																		
A12		•		•	•													
A13																		
A14				•														
A15		•																
A16	••																	
A17	•																	
418																		

• Diameter of steel bar.

▲ Distance of steel bar from nearly end of core.

■ Number of steel bars and spacing between bars.

• Distance of steel bar from vertical axis of specimen.

This brief review indicated that the various proposed relationships for correction factors are all nonlinear. It should be noted that the equations given by the Egyptian Code takes into account most variables that may affect the interpretation of the results; however, the code ignores the deterioration of steel-concrete bond that may occur and also the position of the reinforcement from vertical axis of core specimens.

Weighted nonlinear regression analysis has been performed to determine the factor (F_{reinf}) with the use of the software "SAS" package and "Data Fit." This shows that the correction factor for reinforcement (F_{reinf}) is given by the following expression:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{\left[\Phi_r \times r + \Phi_r \times (S/10)\right]}{\Phi_c * L} \times \frac{1.13}{f_{\text{core}}^{0.015}}\right] \times \frac{1.13}{f_{\text{core}}^{0.015}}$$

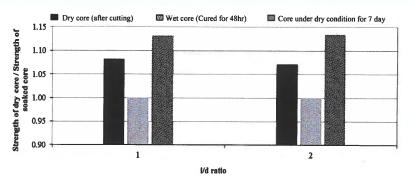
• For core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect is assessed by replacing the term $(\Phi_r * r)$ by $(\sum \Phi_r * r)$ as follows:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{\sum [\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_r * I_r}\right] \times \frac{1.13}{\rho_{0.015}}$$
(13)

where F_{reinf} is the correction factor for reinforcement, Φ_r is the diameter of the reinforcement, Φ_c is the diameter of the concrete specimen, r is the distance of axis of bar from nearer end of specimen, S is the distance of axis of bar from axis of core specimen, L is the length of the specimen after end preparation by grinding or capping, and f_{core} is the concrete core strength (kg/cm²).

6.1.6. Effect of moisture condition of core

Results of about 100 cores indicate that the strength of cores left to dry in air for 7 days is on average 13% greater than that of cores soaked at least 40 h before testing. The strength of cores with negligible moisture gradient and tested after cutting is found to be 7-9% larger than that of soaked cores as shown in Fig. 20. The authors strongly recommend to use a correction factor accounting for moisture condition (F_m) equals to 1.09 and 0.96, respectively, for cores tested after 48 h soaked in water and for those tested after 7 days dry in air.



Effect of core moisture condition on core strength for different aspect ratios (l/d).



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Summary Table, and Pavement Core Photos – Hume Street/Kairistine Lane Alley



2022 Local Street Package - 22-R-05

Hume Street and Kairistine Lane Alley: between Raber Road and Dexter Street

		Paveme	ent Surface		Pavement Structure Ma	terial	
Pavement Core No.	Pavement Core Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Corrected Compressive Strength (Mpa)	
PC22-06	UTM: 5533635 m N, 629037 m E; Located behind #3 Hume Street, 2 m West of East edge of alley.	Asphalt	110	Concrete	-	-	
1 022 00	orial coccoco in it, decoco in it., ecococo bonina no riano careca, e in victor e cast cago or anoy.						
PC22-07	UTM: 5533706 m N, 629033 m E; Located behind #27 Hume Street, 2 m West of East edge of alley.	Asphalt	110	Concrete	-	-	
PC22-08	UTM: 5533749 m N, 629033 m E; Located behind #39 Hume Street, 2 m East of West edge of alley.	Asphalt	90	Concrete	-	-	
PC22-09	UTM: 5533810 m N, 629031 m E; Located behind #59 Hume Street, 2.5 m West of East edge of alley.	Asphalt	110	Concrete	-	-	
PC22-10	UTM: 5533655 m N, 629060 m E; Located behind #17 Raber Road, 2 m South of North edge of alley.	Asphalt	110	Concrete	-		
PC22-11	UTM: 5533656 m N, 629090 m E; Located behind #5 Raber Road, 1.5 m North of South edge of alley.	Asphalt	100	Concrete	-	-	





Photo 1: Pavement Core Sample at PC22-06



Photo 2: Pavement Core Sample at PC22-07





Photo 3: Pavement Core Sample at PC22-08



Photo 4: Pavement Core Sample at PC22-09





Photo 5: Pavement Core Sample at PC22-10



Photo 6: Pavement Core Sample at PC22-11



Appendix H

Summary Table, Pavement Core Photos, and Summary of Pavement Compressive Strength – Telfer Street N.



2022 Local Street Package - 22-R-05

Telfer Street North: between St Matthews Avenue and Ellice Avenue

		Paveme	ent Surface		Pavement Structure Ma	terial
Pavement Core No.	Pavement Core Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Corrected Compressive Strength (Mpa)
PC22-12	UTM: 5528086 m N, 630235 m E; Located 36 m North of St Matthews Avenue and Telfer Street North intersection,	Asphalt	-	Concrete	180	73.99
1 022 12	Northbound lane, 1.5 m West of East curb.					
PC22-13	UTM : 5528155 m N, 630234 m E; Located 111 m North of St Matthews Avenue and Telfer Street North intersection,	Asphalt	-	Concrete	160	-
1 022 10	Southbound lane, 1.5 m East of West curb.					
PC22-14	UTM: 5528195 m N, 630237 m E; Located 160 m North of St Matthews Avenue and Telfer Street North intersection,	Asphalt	-	Concrete	190	70.17
1 022 11	Northbound lane, 1.5 m West of East curb.					
PC22-15	UTM : 5528259 m N, 630237 m E; Located 260 m North of St Matthews Avenue and Telfer Street North intersection,	Asphalt	-	Concrete	190	74.80
1 022 10	Southbound lane, 1.5 m East of West curb.					
PC22-16	UTM: 5528303 m N, 630239 m E; Located 100 m South of Ellice Avenue and Telfer Street North intersection, Northbound	Asphalt	-	Concrete	160	Compressive Strength (Mpa) 73.99 - 70.17
1 022 10	lane, 1.5 m West of East curb.					
PC22-17	UTM: 5528364 m N, 630240 m E; Located 35 m South of Ellice Avenue and Telfer Street North intersection, Southbound	Asphalt	-	Concrete	180	-
1 022-17	lane, 1.5 m East of West curb.					





Photo 1: Pavement Core Sample at PC22-12



Photo 2: Pavement Core Sample at PC22-13





Photo 3: Pavement Core Sample at PC22-14



Photo 4: Pavement Core Sample at PC22-15





Photo 5: Pavement Core Sample at PC22-16



Photo 6: Pavement Core Sample at PC22-17



Concrete Core Compressive Strength Report

CSA A23.2-14C

Project No. 1000-043-19 Date February 11, 2022

2022 Local Street Package - 22-R-05 Technician NM Project

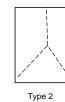
Client WSP Group Canada Inc.

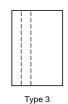
	Core Location		Date Date of Age at Diam Length Moisture		Compressive S	Strength (MPa)	gth (MPa) Correcti		tion Factors*							
		Core ID	Received	Break	Break	(mm)	(mm)	Conditioning	Uncorrected f _{conc}	Corrected* f _c	Туре	F _{I/d}	F_{dia}	F_{mc}	F_D	F _{reinf}
	Telfer Street North	PC12	2022-01-31	2022-02-11	-	95	155	Soaked 48 h	64.55	73.99	1	0.99	1.00	1.09	1.06	1.00
	Telfer Street North	PC14	2022-01-31	2022-02-11	-	95	171	Soaked 48 h	60.70	70.17	1	1.00	1.00	1.09	1.06	1.00
	Telfer Street North	PC15	2022-01-31	2022-02-11	-	95	173	Soaked 48 h	64.65	74.80	1	1.00	1.00	1.09	1.06	1.00

Comments

*Correction factors F_{I/d}, F_{dia}, F_{mc}, and F_D calculated as per ACI 214.4R-03, and correction factor F_{reinf} calculated as per Khoury et al. (2014): $f_c = f_{conc}F_{l/d}F_{dia}F_{mc}F_DF_{reinf}$











Type 6

Reviewed by (print):

Angela Fidler-Kliewer C.Tech. Signature: Angela Fidler-Kliewer

Table 1	Factors in	volved in	interpretation	of core	results	by different co	odes.
							The Broke Street Street

List	Code/standard	Edition	Factors Considered									
			Aspect ratio	Diameter	Reinforcing	Moisture	Damage	Direction				
1	Egyptian Code/Standard Specification	2008	√		√			√				
2	British Code/Standard Specification	2003	1		1			1				
3	American Concrete Institute ACI	1998	V									
		2012	1	V		1	1					
4	European Standard Specification	1998	1	1	1		1					
		2009	1		J							
5	Japanese Standard	1998	1									
6	Concrete Society	1987	1		1		1	1				

In addition, for core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect should be assessed by replacing the term $(\Phi_r * d)$ by the term $(\sum \Phi_r * d)$.

It should be pointed out that above equations used to interpret the core concrete strength to the in-situ concrete cube strength have been developed based on a set of assumptions and through many converting process. It is also of interest to note that the damage effect is considered in the development of the formulas in indirect way. The subject derivation and detailed formulas may be seen elsewhere [14].

3.2. American Concrete Institute (ACI)

3.2.1. Former ACI Code (2002) & Current ASTM (2009)

The methodology of core interpretation given in the former ACI code was remained without changes for decades and up to Year (2003). The in-place strength of concrete cylinder at the location from which a core test specimen was extracted can be computed using the equation:

$$f_{\rm cy} = F_{l/d} \cdot f_{\rm core} \tag{4}$$

where $f_{\rm cy}$ is the equivalent in-place concrete cylinder strength, $f_{\rm core}$ is concrete core strength, and $F_{l/d}$ is the strength correction factor for aspect ratio.

The former ACI code does not include any equation to calculate the correction factor $(F_{I/d})$; however, the code gives different values for this term that is associated with different aspect ratios (I/d) as given in Table 2. It should also be noted that the approach of current ASTM is similar to that mentioned above. The only considered variable is the aspect ratio (I/d). It should be noted that identical approach to that mentioned above is still effective in ASTM C42/C42M-03 [10].

3.2.2. Current ACI Code (2012) [15]

Starting from Year 2003, significant changes have been made to the relevant ACI Code provisions regarding the interpreta-

Table 2 Mean values for factor $F_{I/d}$ according to ACI Code (1998) and ASTM.

	Specimen	length-to-dian	neter ratio, l/d	
	1.00	1.25	1.50	1.75
$F_{l/d}$	0.87	0.93	0.96	0.98

tion of core strength test results. New factors have been considered. These include core diameter, moisture content of core sample, core damage associated with drilling, in addition to the effect of aspect ratio that was previously considered in the former ACI edition (1998). According to the ACI 214.4R-03, the in-place concrete strength can be computed using the equation:

using the equation:
$$f_c = F_{i/d} \cdot F_{dia} \cdot F_{mc} \cdot F_D \cdot f_{core} \quad F_{core} \quad F_{core} \quad (5)$$

where f_c is the equivalent in-place concrete cylinder strength, $f_{\rm core}$ is concrete core strength, $F_{l/d}$ is strength correction factor for aspect ratio, $F_{\rm dia}$ is strength correction factors for diameter, $F_{\rm mc}$ is strength correction factor for moisture condition of core sample, and F_D is the strength correction factor that accounts for effect of damage sustained during core drilling including micro-cracking and undulations at the drilled surface and cutting through coarse-aggregate particles that may subsequently pop out during testing.

The ACI committee considered the correction factors presented in Table 3 for converting core strengths into equivalent in-place strengths based on the work reported by Bartlett and MacGregor [6]. It should be noted that the magnitude of

Table 3 Strength correction factors according to ACI 214.4R-03

List	Factors	Mean values
(1) ^b	$F_{l/d}: l/d$ ratio	
	As-received	$1 - \{0.130 - \alpha f_{\text{core}}\} \left(2 - \frac{l}{d}\right)^2$
	Soaked 48 h	$1 - \{0.117 - \alpha f_{\text{core}}\} \left(2 - \frac{1}{d}\right)^2$
	Air dried	$1 - \{0.144 - \alpha f_{\text{core}}\} \left(2 - \frac{1}{d}\right)^2$
(2)	F _{dia} : core diameter	
	50 mm	1.06
	100 mm	1.00
	150 mm	0.98
(3)	$F_{\rm mc}$: core moisture content	
	As-received	1.00
	Soaked 48 h	1.09
	Air dried ^a	0.96
(4)	F_D : damage due to drilling	1.06

^a Standard treatment specified in ASTM C 42/C 42M.

^b Constant α equals 4.3(10⁻⁴) 1/MPa for f_{core} in MPa.

Table 6	List of co	omparisor	is betw	een tes	ted cor	es to de	etermin	e.										
	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A
A1	+0	•	+0	10	10		•				•	# MI		A	\wedge			
A2																		
A3						-				-								
A4																		
A5																		
A6								-AO	HAO									
A7								-AO										
A8		•		•	•													
A9																		
A10																		
A11																		
A12		•		•	•													
A13																		
A14				•														
A15		•																
A16	••																	
A17	•																	
418																		

• Diameter of steel bar.

▲ Distance of steel bar from nearly end of core.

■ Number of steel bars and spacing between bars.

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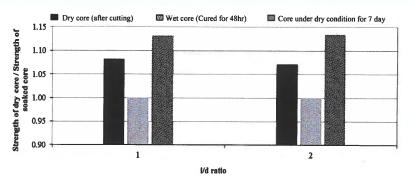
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where F_{reinf} is the correction factor for reinforcement, Φ_r is the diameter of the reinforcement, Φ_c is the diameter of the concrete specimen, r is the distance of axis of bar from nearer end of specimen, S is the distance of axis of bar from axis of core specimen, L is the length of the specimen after end preparation by grinding or capping, and f_{core} is the concrete core strength (kg/cm²).

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